LIBRARY OF CONGRESS
JUN 21 1880
SMITHSONIAN DEPOSIT.

THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXII.—No. 7.
Whole No. 499.

NEW YORK, FRIDAY, APRIL 2, 1880.

$3 PER ANNUM
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

The American News Company, Nos. 39 and 41 Chambers Street, New York, are agents for this Journal. Newsdealers will send orders to them.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIALS—
Edison's New Discovery 145
Gas Furnaces 145
The Working Woman's Cooking Class 146
Correction 146
Tenth Annual Meeting of the New England Association of Gas Engineers 147
Spence's Metal 154
Coal Fields of Colorado 156
Third Quarterly Meeting of the Central New York Gas Engineers' Association 156
Meeting of the Gas Corporation Committee of Birmingham, Eng. 156
Caution 156
Bids for Lighting the Public Lamps in New York City 157
An Improved Process of Manufacturing Coke 157
Lamp Wicks Made of Glass 157
Tides in Place of Coal 157
Oil Tank Explosion in Brooklyn 157

EDISON'S NEW DISCOVERY.

We clip from the N. Y. *Evening Post* the following:

"A gentleman who visited Menlo Park last week on behalf of the Boston *Journal* reports that all except two or three of the paper carbon lamps have been taken down, and that Edison admitted that they had been destroyed."

It would hardly seem credible that the above can be exact; but if it is there is much consolation in the fact that something substantial looms up in the future, if the following from the N. Y. *Times* is true:

"In the intervals of his wrestle with the electric light, Mr. Edison finds time to chip off numerous minor inventions, any one of which should be sufficient to revolutionize the world, if the world knew what was good for it. Mr. Edison's latest discovery is a method by which, it is announced, "he can extract a greater amount of gold from the rejected residuum or 'tailings' of auriferous quartz or sand than is obtained by the present processes from the virgin rocks." In other words, after the ore, crushed and triturated in the usual manner, has yielded its average of 20 to 40 dollars a ton, Mr. Edison takes the refuse and extracts from it—at the merely nominal cost of five dollars—all the way from $80 to $750, or even $1,400 a ton. It is well remarked by the New York *Herald*, from which the account of this wonderful discovery is derived, that "the wealth which is likely to result is beyond computation." Mr. Edison would seem, indeed, to have realized the dream of the alchemists and to have found the philosopher's stone. It is perhaps unnecessary to add that "before allowing his discovery to be known beyond the small circle of his confidential associates," the "Edison Ore Milling Company" was formed, "Mr. Edison himself holding a place in the Board of Directors." The confidential associates have not yet placed their stock upon the market, but it is probable that a few shares may shortly be purchased, at an advance, if any reader of the *Times* desires to go in."

GAS FURNACES.

We commend to the attention of our readers the discussion upon this subject, which will be found in that portion of the proceedings of the New England Gas Engineers Association, published in another column. This matter has not been brought to the attention of our gas makers before the need of its consideration was fully apparent to all who carefully study the tendencies of the gas business.

Upon the eve of a recovery from the depression which has characterized business in general for the past five years, it is a fitting time to determine how the waste of energy in the retort house can be stopped. Necessity has enforced many economies during the past few years, and, as a matter of course, that which most naturally presented itself to the mind of the average careful director has been "a reduction in running expenses," by curtailing running salaries, and "not spending a cent that is not absolutely unavoidable." In some cases a reduction of salaries has been resorted to as a panacea for dull times. We only hope that where this has been done, a return of activity will not fail to bring about a restoration, and, perhaps, an advance of pay in every case where those interested are capable and worthy.

All these temporary expedients, however, are unavailing in reaching the main point. There is one fact that there can be little doubt about, viz., the days of high-priced gas are numbered. The tendency on the part of the consumer is to demand cheaper gas, and this demand must be met by a more scientific proceedure in the retort house. There is where the money is made, and there is the first place to save it; and, so far as the engineer is concerned, it is the only place.

During the past twenty years there has been no radical change in the method of carbonizing coal, if we except the more general use of clay retorts, and the consequent increase of heats employed in the benches. Residuals have been almost utterly neglected; coke was looked upon as rather a nuisance, and as for tar and ammonia water, they were simply pests to be gotten rid of in any way that would remove them from the works. In fact, the gas making was practically "cooking coal," and nothing else.

The introduction of petroleum, and the constant and persistent pushing of it for gas making purposes, on the plea of superior economy, has had a tendency to attract the attention of coal gas men to the real economies of their manufacture, and to look about them to see what could be done to cheapen the first cost of their product. The items of residuals, small as they have been, have attracted attention as something to be placed on the credit side of the account, and caused enquiry as to what is done elsewhere in this regard.

More thorough purification has undoubtedly resulted in an increase in the strength and amount of ammonia water, and the study of the real value of tar as fuel will ensure a better price for that. The coke question remains to be dealt with; and here the application of gaseous fuel to the heating of benches comes in, and it is the most serious problem before the gas maker

to-day. It involves a reconstruction or extensive modification of the present system of benches. But let no man be detered from taking up the study of this question by the fear of *expense*. Money well spent in improvements is sure to bring in a fair return. The true way is to take up the problem carefully and thoughtfully, and having understood the principles involved, and the various means proposed for applying them, to carefully work out the cost and the gain afterwards, and there is no doubt but that the economy will be self-evident. In Germany this matter has been carefully worked up, and the number of applications of gas furnaces of various forms is quite large. In France, also, during the past five years, there have been a number of applications of it outside of the Paris Gas Company. In England they are moving in the matter, and in this country there has been some very successful work done with them. The principle which it is desirable to adopt has been largely worked in the various iron manufactories of this country, and it is time that the gas maker followed suit.

The principle may be enunciated as low heats in the furnace or generator, and high heats in the oven or bench. Coke is placed in the generator and the draft so regulated that a dull read heat is not exceeded, or, as expressed by an able writer on this subject, "Such a heat as will enable one to distinguish each piece of coke." The result of this is that the products of combustion leave the generator in the form of carbonic oxide, which is led into a chamber in the retort house oven, where it is mingled with the heated air and is burned into carbonic acid. The result is a steady, uniform high heat in the bench, which never has to be opened, and a consequent greater uniformity of the gas made, and increased durability of the retorts. Aside from this, there results a great economy in the quantity of coke used for carbonizing the ton of coal, as shown from the fact that the work is done with from 15 to 25 per cent. of the coke made.

One of the main differences in the various forms of gas furnaces consists in the method employed in heating the air which is used in the oven to convert the carbonic oxide into carbonic acid. In the Siemen's system, masses of fire brick, placed under the bench in two compartments, are alternately heated by the products of combustion from the generator, and while these are passing through one compartment the air is passing through the other, and is warmed by the heat stored up in the fire brick. After a time the currents are changed by means of a damper, and the mass that has been cooled by the passage of the air is reheated by the products of combustion from the furnace and the air is heated by passing through the bricks through which the hot gases had passed before the change. This alternating process is called "regenerating." In the Ponsard and the Lencauchez systems the air is air is heated by passing around the outside of a system of hollow fire brick work or channels through which the burnt gases from the oven or bench itself pass to the flues or chimney.

This is called a "recuperative" system. Then there are other systems where the air for combustion is heated by passing around the generator or furnace, and taking up the heat radiated therefrom. The first is the most expensive in construction, and gives the best results so far as consumption of fuel is concerned.

All of these systems require more or less space beneath the ordinary bench; and in any retort house having a cellar, or the benches built on arches, the necessary experiments may be tried with comparatively little trouble. But when experiment or investigation has satisfied the engineer which plan is best adapted to the requirements of his particular case, the true way is to reconstruct the retort house, and arrange it in such a manner as will enable him to avail himself of all the advantages in the most truly economical manner, provision being made for the introduction of mechanical stokers, and the handling of coal and coke by machinery, in such a manner that the item of manual labor will be reduced to a minimum.

Time, of course, is necessary to introduce these changes; but they must come. And that manager who is posted and ready for action, when the opportunity offers, will find himself far in advance of those who follow an opposite course, and he will also be able to put his coal gas in the holder at a price that will defy competition.

The Working Womens' Cooking Class.

AN EVENING WITH MISS CORSON AND THE SHOP GIRLS.

"Tell me what men eat and I will tell you what they are," says Brillat Savarin. Reversing the process of that apostle to the stomach, and to pickles, cheese and baker's tarts one can trace back the combats of the counter and the nervous irritable young dyspeptic who stands behind it.

No class of people in New York is worse fed than the workingwoman, and especially the shop girl. Her raiment may outshine Solomon's, but her stomach is sorrier than that of Lazarus. One of two things is certain in her case; she occupies a room and furnishes her own meals, or she lives in a fifth rate boarding house the terrors of whose cusine must be left unexplored. While the sea and land furnish the markets as are nowhere else found, and with an abundance which comes only from above, everybody knows who sends the cooks. If she lodges and boards herself the last end of that woman is worse than the first. She lives on pastry and pickles and other cold morsels, which she drops like bits of lead down her throat in her haste to do up her things and be off, or to crimp her hair. Such a diet might not harm an ostrich or a blacksmith; but it is bitterness to the internal economy of a woman, and revenges itself in her temper and pasty complexion. The one she can remedy, the other requires more radical treatment. It is a mistake that the girls are indifferent to their diet. As well as another they like hot meals, and would enjoy dainty service; there is no more doubt but they would take equal delight in their own amiability, and prefer leaving the business of snubbing to their fair customers, if they only knew how to accomplish it. The proof that this is so lies in Miss Corson's Wednesday evening cooking class, organized especially for workingwomen, and availed by them to the extent of a room full—that is to say, of at least one hundred women, of whom a dozen, perhaps, are married women, whose deeply-interested husbands gather in the outer hall to escort them home. The greater number, however, are the young ladies, whose intricate hair-dressing, pretty faces and piquant manners add another interest, and one not unmingled with awe, to a shopping tour. They come in couples and bevies, armed with note books and pencils, and they come early to get a good front seat.

Nothing could be simpler than Miss Corson's method. On the blackboard is written the evening's lesson. Boiled rice, mashed potatoes, broiled and fried fish, and omelet. Before her, on a long table, are her array of gas stoves, and her various tools shining and bright, which a little forethought has prearranged—a valuable lesson at the outset. With the peeling of the potatoes and the inspection of the rice, both done by herself, the lesson begins. The minutest details are not forgotten. Everything which comprehends the most perfect cleanliness with the deftest methods are set forth—trifles which an undisciplined cook may grope after but never find. The last potato of winter is to be soaked in cold water that at least its moisture may be restored; the rice is to be cooked with perfectly separated grains; the fish is to be broiled just so many minutes in the wonderful gas broiler on the flesh side, and on the skin side just so long; just so much salt is to be put into the water for boiling. With a calmness inexplicable to the uninitiated Miss Corson predicts the outcome of these dishes, the flakiness of the rice, the moment when the fish will be ready to serve. She does not hesitate to express herself on the ultimate lightness of the omelet. As she mingles its capricious elements she cooly discourses on omelets in general, and while everybody else breathlessly watches the fork, which seems to be the genius of the frying pan, into which the omelet is poured, she continues her discourse and lands the omelet—a frothing fold as had been pre determined—in the centre of the plate and passes it round. Everybody breathes again, and the girls standing in the back rows now sit down. Hereafter an omelet is to be considered not as a ticket in a lottery but as a scientific fact.

No less valuable is the serving of the dishes with a sleight of hand. The rice is dashed from the colander in which it is drained a snowy mass into its dish. The fish does not dare to touch other than the spot on which it is destined to lie, and Miss Corson adds to it the delicacy of some caper butter left from a more ambitious class, and thin slices of lemon as a garnish, whose attractions cannot fail to be felt. The mashed potatoes are neatly smoothed and decorated, and the dishes set forth smoking hot near by a stand of suggestive spoons. The girls put up their note books and gather about the table, the spoons vanish, and the food disappears on the critical tongues of the pupils, who have yet many questions to ask.

The indirect lesson of the evening, and by no means the less valuable, lies in the fact that there is not the least suspicion of drudgery. The second advantage rests with Miss Corson's cooking utensils—the gas stoves. A match gives her an instant glow; a turn of the wrist regulates her fire; there are no coals to be lifted nor cinders to be raked down; and when her dish is cooked the fire is extinguished.

Inquiring of Miss Corson as to the probable cost of gas as a fuel, she answered: "I am using a good deal of gas now, and it cost me three dollars a month."

Cooking thus considered resolves itself into a rather poetic occupation, capable of nice poses and only enhanced by striking toilets, at which each may take joy in taking their turn. This is the wholesome view, and may be the true one if one chooses to take it.—*N. Y. Evening Post.*

Correction.

We regret exceedingly that in our issue of March 2d, in the second column of page 106, the substitution of the word *and* for *are*, in the fifteenth line of Captain White's remarks upon the death of Mr. Edge, most seriously marred the beauty of the tribute to Mr. Edge's memory which Captain White so beautifully expressed.

The error should not have occurred; and we regret it all the more from the fact that the sentence was thereby rendered meaningless.

[Official Report.—Continued from page 129.]

Tenth Annual Meeting of the New England Association of Gas Engineers.

Held at Boston, Feb. 18th, 1880.

Mr. M. S. Greenough then read the following paper upon

HEATING RETORTS BY FURNACES.

Mr. President:—The memoranda which I wish to use in making some remarks are hardly worth calling a paper. It is, I believe, the first time that I have made any address to this Association except in connection with figures which I wished to present to it. This time, however, I have no figures, and the only reason why I ask the Society's attention is that I think it advisable to direct the thoughts of gas engineers, so far as can be done by discussion here, to a subject which we must all soon take in hand.

Every gas company in this country, if decently managed, is slowly but surely reducing its cost of gas. The last ten years have made an enormous difference to most of them; as for ourselves, it has been for the last six months just half of what it was ten years ago. For some of this reduction we can take credit to ourselves—for some we cannot; and to the questions whether the next ten years can show an equally great percentage of decrease in cost of production, and whether we are going to be able to sell our gas at about a dollar a thousand and pay dividends, we can give no satisfactory answers.

It will never be in our power to control the coal market, for the coal market is practically controlled in these eastern cities by the grain crop. When England is short and America is long of wheat, then vessels will come over for it and bring cargoes of coal at low freight, delivering it so cheaply that the great railroads who try to hold us all in the hollow of their hands cannot put up the price of coal too high without driving us out of the home market.

If American crops should be bad and European good, then I fear the price of coal will be put up, and the householder may find that bread and gas, two of the necessaries of life, have both increased in price.

Other elements of cost, however, we can control. We can increase the value of our coke by manipulation, and we can save a great part of the proportion now wasted in firing. We can substitute machinery for labor where it is cheaper, always bearing in mind the advisability of so arranging our works as to only have processes in use that the simplest intelligence can soon acquire. That it is easier for a man to rake coke into a gasogen, and take out the ashes as the bottom, than to continually use his judgment about firing and clinkering, I think is evident; and it is on this point that I want to speak.

I do not propose to give a long description of the various recuperative systems of heating retorts which are in use on the Continent of Europe, but will only state the general principle on which they are all constructed, hoping that those gentlemen present who are familiar with them will pardon my refreshing their minds. Briefly, then, they are all based on this fundamental plan:—

Gasogens or cupolas placed in front or in rear of the benches are filled with coke, the heat of which is never allowed to exceed a dull red. The air in passing through it is first converted by combination with the bottom coke, where the fire is hottest, into carbonic acid, but as the compound goes up through the dull and never highly heated fuel it takes up another equivalent of carbon, and becomes carbonic oxide. This is of course to the last degree inflammable, and to burn it with the proper amount of air under the retort is the next step. This having been done, the products of combustion are then led off through a chamber located directly under the stack, which is filled with tile and heated to a great heat by these waste products. This chamber is generally divided into two parts, through one of which the air comes in, taking up the heat from the tile, while the hot products of combustion, carbonic acid, etc., pass out through the other, the currents being reversed from time to time by valves operated from above. Sometimes one chamber only is used, the heat going out through tile tubes, and the air coming in through the interspaces. In either case the air is brought to the carbonic oxide in a greatly heated state, and the proper heat desired under the retorts is thus obtained with a much smaller consumption of fuel than is necessary by any other process.

At the Paris works, at La Villette, this is not over 16 per cent. of weight of coal carbonized, which, assuming that their weight of coke is 70 per cent. of coal, gives about 23 per cent. of coke used. At Ivry they have put into use since I was there an improvement on the Siemens furnace, and I am informed that they last year *sold* 85 per cent. of the coke made.

Well, gentlemen, the difference between 15 per cent. of coke and what is used in the most economical system at present in general use in this country would make a very handsome sum if sold for a fair price, and would more than pay the interest, I think, on the necessary investment, if we could start afresh and build new retort houses.

There are other advantages which we should also consider. If anybody here is in the habit of taking hourly states of his station meter, he must have been discouraged by noticing how the make will drop off at clinkering time in spite of all he can do. The introduction of cold air and coke brings down the make as much as ten per cent. for an hour or two afterward, a loss which would be entirely avoided by the new process, and the amount saved placed to its credit. Consider, too, the advantages of a setting which is never opened, where there is no tremendous heat directly playing upon the sides of the middle and bottom retorts and eating them out, and no sudden cold draughts to crack them. The much smaller amount of wear and tear to which they will be subjected can easily be seen, and of course their consequent longer duration can be safely predicted. Heavier charges can also be worked off, and more gas made to the fire. The work of the men is somewhat modified also.

Now the cost of these alterations to any ordinary gas works is very great, and to properly do it involves the necessity, 1st, of a stage from which to charge the retorts; 2d, a cellar underneath to look after the generators; and 3d, that the bed should stand on an arch, which contains the recuperators.

I have been considering the subject somewhat, and I do not see how any other place can be selected for a recuperator when the settings are double—*i. e.*, back to back. In small works, when the settings are single, you can place the recuperator where convenient. There are some companies in this country whose beds have been all built on arches, and were I so situated I should consider no process complete which did not allow for a system of recuperation.

Most companies, however, are not so placed as to be able to do that. To tear down a retort house and excavate a place for arches, especially in ground as solid as some works stand on, would involve a very great expense, and we are consequently led to consider if there is not some half-way house at which we can stop, for a while at least, getting some progress over our present wasteful system, without seeking to reach the best that could be done. In other words, if we cannot get the advantage of a recuperator, cannot we at all events improve sufficiently upon our present method to make it worth our while to spend some money?

I think we can. The first system to which I have given particular attention is that of Mr. Oechelhauser, at Dessau, plans of which have been published in the London *Journal of Gas Lighting;* but they seemed adapted chiefly to small works, where there was but one row of retorts, and the furnace supplying his fires was put back of the bed, one furnace supplying several fires. Though not suiting the case of the Boston Gas Co., I have no doubt this plan would greatly benefit works differently built. There is nothing about his plan which prevents a recuperator, so far as I know; but I do not happen to have seen any drawings with one attached. For our use I think his plan can be improved upon.

In England they have, so far as I know, done nothing at all in this line, though the plan of building houses with stages is very common, and there is no reason why a Siemens furnace complete should not be put in at once at some of their large stations, except that proverbial difficulty which makes the Englishman the most steadfast and admirable friend and ally when he is on your side and in the right, but the most obstinate creature living when he is so unfortunate as to be wrong. The *Journal of Gas Lighting* is, however, strenuously urging action, and they are apparently preparing to make this step in advance.

In this country several efforts have been made. M. du Motay patented a process some years ago which has not, to my knowledge, ever been used. Mr. Liegel moved in the same direction not long ago, and more recently still Mr. Dieterich has tried his hand. Mr. Liegel's I have not seen, but Mr. Dieterich's I have carefully examined and been much pleased with. When from a 12″x20″x8′6″ D retort 8500 feet of gas can be taken in 24 hours, in three hour charges, and the retorts last over two years, it is good work; and if that can be done with so small a setting, a proportionate yield from 26″x15″x9′ retorts would be nearly 12,000 feet.

I do not propose to describe at length the various ingenious arrangements by which Mr. Dieterich has simplified his labor, though there are many of them, I think, capable of being transplanted. I wish merely at present to speak of his heating process.

The coke is raked while hot from his two bottom retorts once in three hours into his generator. The heat in this is very great—so great, in fact, that I doubt if carbonic oxide is produced to any great extent. The retorts seem to be heated directly by the products of combustion, although a current of air, which, if not recuperated, has passed through a zig-zag flue beside the furnance, until it has got highly heated, is then introduced to the furnace under the retorts.

Having only once and for a short time seen the process in use, I cannot speak positively, but I should doubt whether the addition of this current

much increases the temperature. Whether the absence of the recuperator is not compensated for by the use of hot coke and by the saving in handling one-third of it, could not be determined without experiment; but the plan seems to me to have great merits, and if the estimated cost of introducing it on a considerable scale does not prove greater than anticipated, I shall hope by this time next year to be in a position to speak more definitely as to its value. Meanwhile I hope that we shall not be the only company who will give a trial to this or some similar plan, and that then it will be possible by comparison of results to arrive at some opinion of the relative value of this process to others.

The President—The subject presented is a very interesting one, and I hope it will be fully discussed. I think Mr. Greenough has called attention to a subject upon which there is a great deal to be said, and I hope you will not let it pass without giving it the attention it deserves. It is a matter with which I have been very greatly impressed. I think, on account of the low price of coke and the difficulty of its competing with anthracite coal in our markets at the prices which have been ruling, we have been ignoring the question of fuel to a large extent. If we get good results in our yield of gas from high heats, we are rather disposed to let the question of fuel go, as we find difficulty in getting rid of our coke. But, as Mr. Greenough states, I think the coke market is in the way of being improved, and that a careful preparation of our coke for the market will greatly enhance its market value; and I think it can be put very closely alongside of coal. If we can only get customers to believe that we carefully prepare our coke for their use, that thus prepared it is something which they can put into their bins, and which is very convenient, on account of its extreme readiness in case a quick fire is wanted or in case a sluggish fire is to be quickened, I think they will take it without hesitation, and that they will be perfectly willing to pay a price for it which will pay us for the extra trouble of preparing it. I hope the members present will give each other the benefit of their opinions upon the subject.

Mr. Yorke—Our experience in Portland for the past few months has been about this: Our price has been 8 cents. As soon as we commenced burning tar the difficulty was to get rid of the coke without having to lower the price; so we went to several manufacturing establishments there which were using a large amount of anthracite coal for fuel, and got them to test the coke at 7 cents a bushel, in comparison with coal. The result is that they find the coke a little the cheaper. One large establishment uses from 150 to 200 bushels of coke per day, and they have been using coke now for several months. We keep the price up to general customers, and, as we get a surplus, we shall probably be able to dispose of it.

Mr. Armington—I heard but a part of Mr. Greenough's paper, but I should like to say a few words in regard to that portion of it that I have heard. One year ago I gave this Association some data in regard to a furnace that we were preparing to put in. There was a law suit over the patent and we discontinued. Now we are about going on again, by the use of a supplementary furnace. I do not know of any better plan of heating benches than the supplementary plan; but, if I understood Mr. Greenough correctly, he don't think the admission of hot air is beneficial.

Mr. Greenough—I have only seen it in operation once. The furnace seems to be constructed on a different principle from others I have seen. It did not seem to me that there could be any free carbonic oxide coming out of the furnace under the retorts. My experience, however, in regard to the matter has been limited, and I cannot speak with that degree of certainty that some of the other gentlemen present may perhaps be able to do.

Mr. Armington—I do not see how combustion could be perfectly brought about without the hot air flues. I have noticed at the top of the benches, at certain times when air was being admitted on top and the furnace was being charged, that there was a good deal of flame escaping, and some free carbonic oxide passing off. The instant it is shut up, and the hot air only is allowed to come in through the flues, combustion takes place at that very point, and it then has the most effect. There is no doubt in my mind that we must have heat to go on with distillation. I think that this subject is one that is entitled to very serious consideration and investigation. It seems to me that we have positive proof of the advantage of these furnaces if they could be used without the danger of becoming involved in a law suit. If we can by the use of them work 8 charges in 24 hours, instead of 6, on the same amount of fuel we now use, it seems to me that is certainly a very strong recommendation in their favor. I have no statistics here showing exactly the amount of fuel these regenerator furnaces use, but suppose they use just as much. Throwing that question entirely out of the calculation, the extra amount of coal carbonized would more than pay for everything, without the cost of a dollar for extra labor. In fact, the cost of labor would be less. There was one of these furnaces put in in New York. I have no detailed information in regard to its operation, but I have no doubt that it worked very well indeed. All that is required is a retort house well fitted for the purpose, and with some better way of taking care of the coke than we now have.

Major Dresser—It would seem to me that the point made by Mr. Greenough with reference to the formation of carbonic oxide in the furnace, is not well taken. Certainly the temperature of the furnace is not high enough to produce dissociation. Oxygen or free air is admitted through the gate below and comes up through, and the chimney of the oven shows no flame. If you examine the tops of the benches you will see no flame coming out of the chimneys except at such times as the covers may be off, when they may be filling the furnaces with coke. When you get an excess of air, then you have a flame, but if the air is admitted in the proper proportion, the carbonic acid is burned in the oven. That is the reason you are using a gaseous fuel. The object of these furnaces is to secure heating by a gaseous fuel. Of course we all know that you cannot take a ton of coal and make gas from it, and then take the gas that you make out of the ton of coal and get as much heat out of it as you can out of the ton of coal applied directly, although such claims are made by some people. I do not yet believe that any man can get into a bushel basket and carry himself upstairs by the handles without the use of any outside power. Perpetual motion is not yet discovered, and you cannot get more out of a thing than there is in it; but the convenience of application, and the increased durability of your benches, the uniform and steady heat, and the perfect combustion, overcome the loss resulting from the difference in the quantity of heat obtained from the coal and the heat obtained from the gas. That is the reason, also, why they save labor. For my part, I am very glad to see this ball set rolling. I think it is time something was done in this direction in this country. I do not think we ought to be content to follow the lead of somebody else, but I think we ought to go ahead and do something for ourselves, and I hope there will soon be an adoption of gas furnaces for heating retorts. (Applause.)

Mr. Greenough—In answer to Major Dresser, I desire to say but a few words. I am loth to get up and express myself upon a chemical problem, but, as I understand the operation of these furnaces, it is very improbable that there is any carbonic oxide. For information in regard to the Liegel furnace, I am indebted to a very valuable paper by a French engineer named Monnier. The coke never passes into a high temperature, and the oxygen not coming up through it, the coke is not thoroughly burned. When the temperature of the coke is raised, as in the generator of Mr. Dieterich, I doubt very much whether there is any great amount of carbonic oxide.

Mr. Armington—Do you think that that furnace would do anything like the work that ours will do?

Mr. Greenough—I do not mean to say so at all. It is a matter which is, undoubtedly, one of experiment, but in looking over the drawings of these different furnaces, and comparing them with the theoretical working of the French one, I did not wish to write anything on the subject without bringing that up.

Mr. Armington—I simply want to make this point: You speak in your paper about the loss in distillation, owing to the fact that we use opened furnaces. But now we do use closed furnaces in burning tar, and we do not work off but 6 charges in 24 hours. There must be something in this supplemental furnace which gives us the extra heat, and I think it is due to the carbonic oxide, and to its conversion into carbonic acid, which takes place at a certain stage by the heated oxygen coming through these flues. If you should shut off these flues for a short time the heats would run down. I think experiments of this kind show that carbonic oxide is there. When we walk through our retort houses we see flames rising out of the chimneys from eighteen inches to two feet in height; and what is that flame but mere waste fuel? I introduced a pipe into the lower flue through the stopper hole, and then I had a register on the outside connecting with the pipe, and measured the amount of oxygen, and I could entirely stop the flame, so that I could not see it at all. I supposed, of course, when I stopped the flame, that I was burning carbonic oxide, and therefore that I should get a much greater heat. On the contrary, the heat ran right down, and I had to take off that pipe and put on a double one, which heated the oxygen as it passed in, and gave it a double heat; and still the heat ran down. That led to an analysis of the flame, and I found 65 parts of nitrogen, and something else that had no heating qualities at all. I think that indicates that when this heated air, passing through these single pipes, comes in contact with the carbonic oxide, it produces the intense flame, and heats up the bench. One reason that makes me think so is that there was a little incline in connection with a furnace that was being tried, and the carbonic oxide ran up this incline. The clinker formed to such an extent (there being no means of getting it off at the time) that it choked up the passage and made the furnace inoperative until the clinker was knocked off. This clinker could not have been produced from the coke, because it was produced where there could not have been any coke at all, and must have been from the excess of heat at this point. I think it is a very vital part of the furnace—the condition of the air at that point.

Mr. Yorke—I have tried the experiment, and I have found that where there is a coke fire you will not find that blaze. I find no flame coming out after the coke becomes incandescent, but before that time we will have more or less flame. A very little extra admission of oxygen will seem to make a better combustion in the arch of the retorts. I have noticed that frequently. I cannot tell why it is so; I suppose it requires a little more oxygen at certain times. I have tried it time and again. The moment I saw the flame coming out I would open the door a little way, and down would go the flame; then, after a short time, probably half an hour or so, I would close the door again.

Mr. Neal—When the furnace has been in use for some time, is there enough air admitted around the crevices of the door to supply the necessary amount of oxygen?

Mr. Yorke—There may be too much. There may be an ample quantity at that particular time, but there are certain times when it is not required, and then it does more harm than good. It does not require this large amount of oxygen all the time; it is only for a certain time. Any of you gentlemen who feel disposed to do so can easily test the facts I have stated. If you open the door a little way, down will go the flame; and the result is that the combustion is more perfect.

Mr. Greenough—I would like to inquire of Mr. Armington if his retorts are built on arches.

Mr. Armington—Yes.

Mr. Greenough—Do your beds stand on arches?

Mr. Armington—Yes.

Mr. Greenough—Have you given any consideration to the subject, or have you any idea about recuperative furnaces?

Mr. Armington—Yes; I should like very much to save my head foreman a great deal of trouble, but I am afraid to do it. I am afraid of cutting up through these arches, and subjecting the lower part to the extra amount of heat. If they were well constructed of fire brick I would not hesitate about cutting through them; but they are not fire brick. We have a cellar that is about 10 feet deep in the clear, and I suppose it is about 12 feet from our grate-bars to the bottom of our cellar. Putting in this furnace will necessarily inconvenience us in handling our coke. We cannot have room enough to drive our carts along in front of our arches in the cellar as we now do.

I do think, gentlemen of the Association, that it is time we moved in this matter, and time that some reform was inaugurated in our present system. It seems to me that if there is any way in which the loss of energy and material, which is one of the evils of our present system, can be obviated, we should not be slow to adopt it. Our friend Mr. Vanderpool can probably tell us a great deal about combustion. He has recently published some papers showing a very small consumption of coke, and I hope he will give us the benefit of his experience.

Mr. Vanderpool—I do not think I can add to the information contained in the able paper of Mr. Greenough. He has covered the ground. I would merely say that I am fully of the opinion, from what I have seen and know of the gas furnace, that its use is a marked advance, and one which we must adopt. There is an enormous waste in the method of heating retorts in general use. There are many works where the use of fuel ranges from 40 to 60 per cent. of the coke produced. It is well known that the same, or rather much better work, can be done by the use of from 15 to 25 per cent. Much attention has been paid to this matter in France and Germany, and in this respect they are far ahead of what we do here. In England they have not given as much attention to the matter, although there the consumption of fuel is on the average far less than with us. As I now remember, the average consumption of the Metropolitan companies for the year 1878 was not over 27 per cent. of the make, one company having used but 23 per cent. They are now devoting a great deal of attention to this matter, as evinced by the discussions in their gas associations. As one instance, I might mention the discussion at the late meeting of the Manchester District Institution of Gas Engineers, where a paper was read upon the subject by Mr. Webber.

I also understand that they have erected a number of the Liegel furnaces at the South Metropolitan Works, London.

There are many forms which the gas furnace and its construction may take. For instance, at the Ivry station of the Paris Gas Company they use a modification of the Siemens furnace; then there is the Liegel furnace and Oechelhauser's generator furnace, adopted by the German Continental Gas Company, and the Dieterich furnace used at Baltimore. It seems that all of these are more or less meritorious. The use of the gas furnace will undoubtedly give a great economy of fuel, better and far more uniform heats, and increased yield of gas from the same weight of coal, with a probably increased illuminating power. There is also an economy in labor, and in the item of wear and tear of retorts. We have, I think, arrived at that point in the manufacture of gas in this country where we will be compelled to make no inconsiderable part of the future profits of our undertakings from economies to be obtained in this and other directions. We certainly can very much cheapen the cost of our gas by the use of the gas furnace, the mechanical stoker, and by the mechanical handling of our coal and coke. These improvements are and have been in separate use, mostly, in large establishments; and the evidence of there merit is beyond question. I have in mind one establishment that did good work in the old way, where, by a modification in the direction of mechanical stoking, the cost of labor in the retort house was cut down more than 50 per cent. (Applause.)

Mr. Armington—Will you tell us some of those places where they carbonize down to 15 per cent.?

Mr. Vanderpool—I would say in reply to Col. Armington's request for statistics, that there are many such recorded. The sales of coke at the Ivry station of the Paris Gas Company are, I understand, 85 per cent. of that produced; in other words, if a ton of coal yields 42 bushels of coke, 6.3 bushels of it suffice to carbonize it, and there is left for sale 35.7 bushels. I have been informed that the two Liegel furnaces in use in this country carbonize the ton of coal with less than 9 bushels of coke. There can be scarcely a question that a ton of our standard caking coal can be carbonized in the best manner by from 8½ to 10½ bushels of its coke consumed in a gas furnace.

Mr. C. H. Nettleton—I cannot allow the discussion to close without saying a word about Mr. Dieterich's process, which I saw in Baltimore about a month ago. I went on there to see it, and was really charmed with the simplicity and effectiveness of the process, and with the perfect combustion he obtained. I cannot add anything to what Mr. Greenough has said, except, perhaps, in the way of a few details. We went on the top of a stack of twelve benches of sixes, and there were only two of them that showed any flame. I stood close to one, and could hardly feel any heat. I passed my hand within a foot of the top of the stack, and there was only a current of hot air. I don't suppose I could have held my hand for any great length of time in that position. I drew it slowly across the top, and could only feel a current of hot air striking against it. Mr. Dieterich claims to get along with from 22 to 24 per cent. of his coke, and he is that sort of a man that when you talk with him you are convinced of the honesty of his statements. He said that he measured his coke carefully and that was the result. In the first place, as Mr. Greenough has told you, he draws the charges from the two lower retorts, and charges the lower retorts lighter than he does the others, yet you cannot see any difference. He does not use to exceed one-third of the coke produced. He burns off 225 pounds in each retort in 3 hours. The air is introduced on each side. As to its effect on the flames, when for any reason Mr. Dieterich wants to "miss" a bench for a time, as is frequently the case, he closes up these air flues, merely throws some breeze on the top of the furnace. When he wants to get up his heats again, he simply opens these air flues. He told me that the furnace used little or no fuel for 36 or 48 hours, and inside of 3 hours he says he can get it back to a heat where it will do to charge. If the furnace has been idle for a week, he charges it within 3 hours, and then lets the charge remain in 6 hours before charging again. If it has only been idle a day, he is ready to use it in 3 hours.

Another thing that struck me was that he can so regulate the heat that he can get almost any yield he wants. Of course, I am merely giving you his statement; but it was made to me in such a manner that I believe it. Now, if it is possible for him to get along with so small a percentage of coke, will it not pay us to adopt some such method? I am so well convinced that it will pay us, that I am urging my directors to allow me to put one in, and I hope to succeed. If I do, I will be glad to give you some information at our next annual meeting.

Mr. Yorke—I would like to inquire what yield per pound he obtained from his coal.

Mr. C. H. Nettleton—When he was using wet coal he was getting 4.88, and he stated that his average candle power was 17.88 candles. At that rate, 4.88 from wet coal would be equivalent to 5 from dry coal, and that yield would be entirely within my control. I believe I can get more candle feet out of that yield, but I think that is an economical point to work at. I believe one of our members has had some experience in connection with the combustion of coke, and it would, I am sure, be interesting to hear what his results were. I allude to Mr. Rollins, who, I think, tried some experiments with the Jarvis gas-consuming furnace.

Mr. Rollins—I cannot say very much in regard to that experiment, for I did not run it long enough. While I did use it, I was advised to quit the use of it, and therefore I may say that I did not get any benefit from it at all, so far as I could tell, from the amount of fuel consumed and the quantity of coal carbonized in my retorts. I used it but two or three weeks. The fire-box was of common material, and burned out very soon, but I don't know as it burned out any sooner—just about as soon, in fact, as the bench next to it. So far as I ran it, I do not know that I received any benefit from it at all. There are others here, I believe, who have had something to do with the same kind of an arrangement. Mr. Andrew, of Chelsea, had

one put in, and I think there are one or two others; and it would be interesting to hear their experience.

Mr. Andrew—I think Mr. Jarvis told me that Col. Armington had put one in. I don't know whether he used it or not.

Mr. Armington—It is true that I did put in an apparatus, but it did not amount to anything.

Major Dresser—There is another point in regard to this matter that should not be overlooked, and that is that it has been very clearly shown by experiments conducted by thoroughly reliable men that you get a better quality of gas when charges are run for a short time than when they are run for a long time. Another advantage is the uniform heats that you get from these gaseous furnaces.

Mr. Harbison—What is the depth of this furnace?

Major Dresser—About 8 or 9 feet below the floor.

Mr. Harbison—What is the width of the furnace?

Major Dresser—About 5 feet.

Mr. Harbison—Is it possible to make this furnace water-tight?

Major Dresser—Certainly.

Mr. Harbison—I ask the question as bearing upon the point of how the rise and fall of water would effect this furnace. The Connecticut river rises and falls 24 feet, and when the present grate-bars are only 12 inches above high-water mark, I would like to inquire how this Dieterich furnace can be introduced?

Major Dresser—Build a new retort house just as soon as you can, and put it up higher. (Laughter.)

Mr. Coggshall—In reference to the point suggested by Major Dresser a moment ago, I would say that in our experiments we have found that the higher heats we ran, and the shorter charges, the higher illuminating power we got; and that is the experience, I believe, of a great many persons who have been watching the matter.

Mr. Armington—There is a good opportunity for an argument there, and we have hardly time now to discuss it fully. I think it takes a certain degree of heat to work the volatile matter out of a pound of coal, and it matters very little, it seems to me, whether you do it in 5 minutes or in the ordinary time. If your heat is excessive, of course you work off that volatile matter in a short time; but what you get will be equal, and nothing more.

Mr. Lamson (Boston)—I beg to differ with Mr. Armington. We have a record of experiments which we tried at our works. It is estimated among us, I believe, that a pound of coal will yield about 4¼ feet of 16-candle gas. The results of some of our experiments show that we have taken out that amount, and perhaps a little over—running up to 19 and 20 candles. These are absolute facts, and I believe it is accounted for simply by different methods of applying heat; and the same thing has happened to us quite a number of times.

On motion, the Association then adjourned until the following morning at 10 A. M.

At 5 P. M. the Association sat down to a banquet in the large hall of Young's Hotel.

SECOND DAY—FEB. 19, 1880.

The Association met at 10 A. M., and was called to order by the President.

On motion, the reading of the minutes of the session of yesterday was dispensed with.

Mr. Stiness—As it is customary to make such a motion at some period of the meeting, I move that the printing of the reports be left entirely with the President and Secretary.

Carried.

Mr. Neal—I am not aware that there are any more papers to be read. All the papers that were submitted to the Directors have already been read before the Association, and have been discussed. I would suggest a subject that may be of interest to the superintendents of gas companies present, and that is the subject of crushed coke. Many companies find it difficult to dispose of their coke, and others find no difficulty whatever. As far as our company is concerned, all of our coke is sold as fast as it is made. We have no stock on hand, and, as I said yesterday, we are obliged to draw upon the Boston Company; but there are several companies represented in this Association who find it more difficult to dispose of their coke. The Boston Company have tried the experiment of crushing their coke, and I am told by Mr. Greenough that it has increased the sale. I think it would be a profitable and interesting subject for discussion as to the economy of crushing coke, and whether the sales can be increased by that means. Mr. Lamson, Mr. Wood, of New Bedford, and others will probably be able to give us some information on the subject.

Mr. Lamson—We have done a little something in that direction, but not a great deal. Our production of coke is very large, and the price of anthracite coal has been so low for the past two years in Boston, that it has been a very hard matter to dispose of so large a quantity as we make. In January, 1879, we had a large amount—about 10,000 tons—and of course it would be a very hard matter to dispose of that much, besides what we made in 1879. We were obliged to sell it at a very low price. We have some customers who take large quantities, but still it left us a very large amount that we could not get rid of easily, and we had to dispose of it to the gas companies around us, and then we urged this one and that one to use coke under their boilers. In that way we got rid of our surplus, and managed to sell what we made in 1879, with the exception of the last two months. In November we tried the experiment of crushing coke. We had a coke crusher put up, and are now crushing coke at our works; and the demand for it is increasing slowly. We sell from 10 to 20 tons a day. We charge $3 a ton for the coke; after crushing we charge $3.25. We find that the extra 25 cents does not pay for the labor of crushing, but after we get the trade worked up to a sufficient point to warrant it, we shall put up an apparatus for taking this coke from the place where it is quenched to carry it up into the crusher. In that way the expense of crushing will be very much reduced. The main object is to create a demand for it. It is always a matter of effort with us to get more money for our residuals. We have paid a good deal of attention during the last year or two to selling our ammonia water to advantage, and we are doing quite well. Now we are turning our attention in this direction, and this was the first step in trying to get a trade built up, and get people to use crushed coke. After we get it well established, we shall be able to raise our price. In places where it has been adopted they prefer it to coal, as it is better for cooking. The coke crusher at our works is put up in a very crude manner. We are crushing by hand, but that is not at all what is intended when the increase in the demand shall warrant the putting up of proper apparatus.

Mr. Wood (New Bedford)—We have been through a similar experience to that just related. Our works, of course, are small, and we could not afford to fit up a machine and run by power, and we have done our crushing by hand. We charge 50 cents extra for the coke broken. We have had to sell coke at the same price named by Mr. Lamson, $2 a chaldron or $3 a ton for coarse coke, and we sell it for $2.50 per chaldron and $3.50 per ton broken. We had last year at this time perhaps 1500 tons of coke on hand—I mean net tons—and after getting the thing started a little, and taking a little pains to introduce the sale of it, we have started a trade that has taken away all the coke. About a week ago we ran out the last bushel, and we are now entirely clear, only just as we make it from time to time, and have not enough to supply the demand for it. We are proposing to raise the price a little—half a dollar a ton. I don't think we any more than get paid for the crushing; hardly that. There is considerable waste in crushing with the machine that we are using.

Mr. Lamson—The waste is a small percentage with us.

Mr. Wood—It is not less than 10 per cent. with us. However, we can use the waste under our boiler, and it is not actually a loss, but it is a waste in the sale.

Mr. Neal—I think these questions are very interesting, especially to companies who have a large stock of coke on hand that they can not dispose of, viz.: Is the sale increased by crushing? Can a better price be obtained? How is the coke crushed? In some places it is broken, and not crushed. It is broken by means of a mallet, or long-handled hammer. I think Mr. Cushing has had some experience in crushing coke.

Mr. Cushing—I have always been in the habit of breaking my coke. I have never sent any coke to the general market without breaking. We have tried a crusher, but I must say that our experience with that has not been in favor of the crusher. I had an opportunity of using a little stationary engine on a crusher that we had. I tried the experiment of using the same number of men with hammers, and seeing what the result would be. I found that with 5 men running the crusher and 5 men with hammers, the men with hammers would crush three times more than the men with the machine, and so I gave up the machine. There is a tendency to waste, or rather shrinkage in the measurement, in crushing coke. We sell our coke by measurement—so much per chaldron. We get $4 a chaldron delivered, and we have no difficulty in selling all that we make. This year we have made an unusual quantity. On the first of January we had about 1000 chaldrons on hand. We have an unusual supply at this time, but it will all go away before summer time comes.

Mr. Lamson—The crusher that we use will crush 5000 bushels a day. If you were to put 8 men around it they could not shovel in fast enough to supply the machine. The question with us is getting the coke to the machine, and getting it away from underneath it; but we can remedy that if our demand warrants the extra outlay for the necessary apparatus.

Mr. Cabot—We have a crusher, and we get a very large percentage of fine coke.

Mr. Lamson—If the blades of these machines are made very thin, so that

they cut the coke, I think you will find the percentage of fine coke very small.

Mr. Cabot—We have a large yard concreted, and the night's work is carried out in barrows and dumped, and the day's work is carried out and dumped in the same place. Just as soon as the coke is crushed it is carried out, and is handled but once.

Mr. Lamson—Do you put your coke in baskets?

Mr. Cabot—All we deliver is in regulation baskets.

The President—Perhaps some of these gentlemen can tell us how much it costs to fit up a crusher to be used by hand.

Mr. Wood—I do not know that I remember exactly. I think it was either $100 or $125 that we paid for the machine to begin with, and I should say that it cost about $5 to fix it up. We put it in our shed so that the top of the machine is just as high as the beams—the cross beams in the shed. Our shed is fixed so that we can fill it from below with our barrows. Then we have an arrangement running up outside, coming into the end of the shed over the beams, so that we can dump the coke down. We carry our coke up and dump it on the floor; then it is just on a level with the top of the machine, so that the men can shovel it into the machine very easily, and the coke drops down below. We generally crush about 3 tons at a time. We have an arrangement for receiving the dust, which is carried off to the boilers. I think that two men can crush about four chaldrons in a day.

Mr. Neal—I would like to ask our President to give us the results of his experience in using a crusher, and also the methods he employs for sifting the coke as it comes from the crusher.

The President—I introduced a crusher some four or five years ago, to be run by power. I had the screens so arranged as to make three different sizes. The first one was a ¾-inch mesh. That takes out all of the breeze that comes from the crusher. The next is a 1-inch mesh, which makes a size which we call No. 2 coke, and sells at the same price as coarse coke. The next is a 1¾-inch mesh, which takes out the coarse coke, or the coke that is not sufficiently crushed to go through the others. That comes out of the end of the screen. The coke falls in that way into different bins, thoroughly screened and perfectly clean. The screen is operated by the same power that runs the crusher, and it costs nothing to have the coke dumped down. The crusher probably works a little different from any of those that have been described. It consists essentially of a box, in the bottom of which are stationary teeth. Between these standing teeth are sets of teeth that revolve very rapidly—say 300 or 400 revolutions in a minute. The teeth are made square, with sharp corners, which present themselves to the coke. With the rapidity of the revolution the teeth strike the coke a steady blow. The teeth strike the coke in precisely the same manner as a vigorous blow of a hammer, breaking the coke into a number of small pieces, and throwing it clear out of the machine into the screen. It has always worked very well. I don't know exactly what the capacity of the machine is, but I think it would break 200 or 300 bushels an hour, if anybody could feed the machine as fast as that. We have customers now who formerly would not use coke. We used to take the coke from our retorts and put it into the cellars of our customers and let them break it up, but they found fault with the trouble of breaking it, and also found fault on account of the waste. By delivering it already prepared, we have secured a class of customers who would not otherwise use it; and, being prepared ready for use, they are willing to pay much more liberally for it than when they had to break it themselves. Being ready for use when it is delivered, in an ordinary cooking stove or grate, without any trouble of preparation, we have been able to reach a large class of customers that we would not otherwise reach, and we have almost always been able to dispose of all of our coke, and to realize a better price for it than we would otherwise have done. Last summer we had an experience that I suppose we have all had, in the competition caused by the low price of anthracite coal. Of course we could not sell our coke at $3.50 per chaldron, with anthracite coal selling at $3.55 per ton, and the result was that we had an accumulation of coke in our yard for the first time in several years. It is all gone now, however. We reduced the price to $3 per chaldron for broken coke, and sold it very readily at that price, so that we have not a particle of coke on hand, and have not had for a month; and we are thinking of putting the price back to $3.50 per chaldron, and I believe we shall be perfectly safe in doing so. We did get last spring $4.50 for broken coke, but when coal went down we found it necessary to reduce the price temporarily, to compete with coal. For myself, I have no doubt about the desirability of preparing coke thoroughly for the market. You get a better class of customers, and you retain them by always giving them an article that they can depend upon for use. Its convenience for use in rousing a sluggish fire, and its perfect adapability to grates and open fires, render it a very desirable article of fuel. You have only to attract the attention of the people, as we have tried to do, by circulars and by advertisements in the papers, and point out is desirability; and they will take it largely (at least, that is our experience), and you will realize a better price.

Mr. Neal—It is well known that the income derived from the sale of coke, tar, and other residuals by English and French companies is quite large, in some instances paying the cost of the coal. Perhaps Mr. Greenough can give us some information as to whether those companies crush or break their coke, or whether it is sold as it comes from the retorts.

Mr. Greenough—I do not think the English companies crush their coke, at least I have seen nothing of that kind or heard any suggestion to that effect. They don't succeed with their coke in the same way that they do in Paris. I think it is very possible that there are gentlemen here who are better informed on the subject of treating coke over there than I am, as the only works I have seen on the Continent are those in Paris. In Paris, as I presume many gentlemen here know, they have a very elaborate and expensive system of machinery by which they work up their waste coke into a merchantable form. They have a way of breaking into fine powder and mingling it with pitch, and making it into blocks for use by the railroad companies. I understand that trade is being followed in this country to some extent, and there is no reason why waste coke should not be used in this way. I think the admixture of coke and pitch will prove to be a very great advantage. I do not think the English companies break their coke at all; but they certainly do get excellent pecuniary results with it on the Continent, especially in Paris. I think Mr. Vanderpool can give you more information on this subject than I can.

Mr. Vanderpool—In reply to Mr. Greenough, I would say that I did not see anything in the direction of crushing the coke being done in any of the large English works. It is done, however, to some extent in the smaller establishments, and you will find an interesting paper, accompanied by drawings, on this subject, in the proceedings of the British Association of Gas Managers for the year 1877.

I did not see any crushing at the works I visited in Switzerland and Germany. At La Villette Station of the Paris Gas Company they have machinery for breaking up their coke into sizes suitable for the stoves made and sold by the company. I might say that the company have, during the past 15 years, sold many thousands of these stoves, and have thereby made a constant demand for their coke, which is a source of large revenue to them. The breeze and dust is made into bricks with pitch, and is used about the works or sold. Coke is our largest and, at present, by far our most valuable residual, and anything that will enhance its price is of great importance to us, and worthy of the closest attention. A large percentage of coke produced, sold at a good price, means a large reduction in the cost of coal, and a consequent economy for every thousand feet of gas made.

It is certain that coke is a valuable fuel, and that a pound of good coke is worth for the generation of heat as much as a pound of coal, and for some purposes even more. It seems to me that it is of the utmost importance, and especially at this time, when the coal gas companies are passing through an ordeal they have never before been subjected to, that every company should obtain the full value of their residuals, whether the same be tar, coke, or ammoniacal liquor. The future economy of coal gas making in this country depends more largely upon the price received for residuals than anything else. There has been comparatively little attention paid to this question here, but it is now, it seems to me, a very vital one. By careful attention to this matter, foreign companies reduce the prime cost of their coal 50 per cent. and upward, in some cases the residuals cover the cost of the coal and labor. When we reach this point, or, indeed, when we get somewhere near it, by attention to and the adoption of improved methods, our position will be very secure.

Mr. Neal—Do you crush your coke or break it?

Mr. Vanderpool—No, sir; we have a ready sale for our coke. There is a large manufacturing establishment in our town that takes a large proportion of our coke. We have a very excellent market for our coke, and have had for several years past.

Mr. Neal—At what price do you sell your coke?

Mr. Vanderpool—Our price last year was 8 cents a bushel in the yard. If the place of delivery is some distance from our works, about 50 cents a chaldron for delivering it.

Mr. Yorke—What is the price of anthracite coal?

Mr. Vanderpool—It has been very low during the last year. I think it has been selling during the past year at something under $3 a gross ton—that is, for domestic sizes. I think the price is about $4.50 a ton now, for the best quality of anthracite coal. There is a difference in that respect.

Mr. Cabot—I do not know that I can add anything to what has already been said, but it may be useful to some of the smaller companies to state what little I know about the matter of coke. My experience has been very similar to that of Mr. Cushing. We have always broken our coke, from the commencement of the works, or very soon after; and we have always found a ready market for all the coke we made. We have always screened, or made two or three sizes of coke. About two years ago, about the same time or soon after Mr. Cushing bought his machine for crushing, I visited Lowell for the purpose of looking at it and examining it. I bought one of

Mr. White's machines about the same time Mr. Wood bought his. I did not drive it by power, I drove it by hand, and my experience with it was that the percentage of dust was very much increased by the crusher, and, after making a good many tests, I returned to the breaking of it by hammers, and abandoned the machine. We don't use a hammer exactly; it is more like a pick. Striking the coke with it cracks it very much like the machine referred to by the President, and makes but very little dust. We find as a matter of economy that breaking by hand is decidedly cheaper. We have no difficulty in selling our coke after it is broken. Whether large companies like the Boston Company find it more economical to break their coke or not, I cannot say.

Mr. Vanderpool—What size do you try to arrive at in breaking it?

Mr. Cabot—About egg size.

Mr. Vanderpool—Have you made an estimate of the amount of dust?

Mr. Cabot—Yes; both by weight and measurement. I have the percentage. It is very nearly 10 per cent. from dust.

Mr. Vanderpool—What do you do with it?

Mr. Cabot—We use all of our dust. We find a market for it. We use it under our boilers, and also have a market for it. We screen our coal and get a dust, and we get out from our coke pieces about the size of a walnut which we find a ready market for.

Mr. Vanderpool—What is the expense of crushing per bushel?

Mr. Cabot—I can give it to you correctly. I have it among my memoranda.

Mr. Stiness—I do not cart away a particle of dust. About a year ago I purchased one of Parson's steam blowers for the purpose of burning dust under my boilers. The blower is not in use one-quarter of the time. I burn up everything that is scraped off the ground. We don't waste a particle, and my coke bill is increased to that extent. I am compelled to sell my coke at four cents a bushel, and break it up at that. The entire sweepings of the yard are burned under the boilers by using fine grates, and the blower is not in use one-quarter of the time. There is no occasion for any gas works in this country carting away a particle of dust.

Mr. Vanderpool—How far will a bushel of these scrapings go?

Mr. Stiness—I hardly know, because we don't generally keep much of an account of it. Certainly, for over a year, I have not wheeled out of my yard a particle of anything except what comes from under the ash pits of the retorts. I think it goes as far as coarse coke. We burn every particle of dirt possible under our boiler. Our foremen have become so accustomed to it that they don't use the blower more than one-quarter of the time. We make a large amount per day in the saving of coke in not burning it for fuel.

Mr. Cabot—I find on my memoranda that in 1878, I made a correct test, without the knowledge of the men who were doing the work, of the cost of breaking the coke and delivering it. The cost of breaking the coke and putting it in the wagons at that time, at the price we were paying for labor, which was the ordinary price, was 23 cents per chaldron.

Mr. Vanderpool—Does that include the 10 per cent. wastage?

Mr. Cabot—That is the cost of breaking it and putting it into the wagons. That was in December, 1878. I made the test with a coarse coke crusher, and by hand. I crushed 50 bushels, by hand, of coke as it came from the retorts; and it gave me 45 bushels of coke for street consumption, two bushels of fine coke, and three bushels of dust. This is all by measurement. Then I crushed the same quantity by the crusher, and it gave me 40 bushels for street use, what we call egg size, 2½ bushels of nut, and 7½ bushels of dust. That was the result of the test by the crusher. The time occupied in the first instance, when the coke was crushed by hand, was one man two hours and ten minutes. Time by crusher, one man four hours and 40 minutes.

Mr. Lamson—Where was the four hours consumed by the man in crushing with the crusher? Do you include the man who was turning the crusher?

Mr. Cabot—That was equal to one man four hours and 40 minutes—shoveling it in and turning the crusher. The crusher was worked by hand. We use our dust under our boilers, and what we do not use we find a market for, as I have said. We have one or two small establishments that take all the dust we can supply. We have a chemical works that use coarse coke without being broken. They prefer it to fine. They get a very hot fire from it, and a very excellent flame for their purposes.

Mr. Rollins—I made a little experiment with the Parson's blower spoken of by Mr. Stiness, with breeze and coke. I took a chaldron of breeze, a chaldron of coke, and a chaldron of very fine breeze, that I screened through a screen of one-eighth of an inch mesh I believe it was. I found that, with the chaldron of unscreened breeze, I ran 13 hours. With the chaldron of fine-screened breeze I ran 10 hours, and with the clear coke, just as it came from the retorts, I ran 17 hours. As the very fine breeze was worth almost nothing to me, I concluded that the blower paid me.

Mr. Vanderpool—That may be accounted for by the fact that combustion was not carried on in the same manner. I suppose there is no doubt but that a pound of breeze will go as far as a pound of coke, and that you can get as much heat from it if you burn it in the right way.

Mr. Rollins—The test was not by the pound but by the measure.

Major Dresser—Did you make any calculation as to the difference in weight of each chaldron?

Mr. Rollins—I did not.

Mr. Vanderpool—There would be more weight in the breeze than in the coke.

Mr. Rollins—The breeze was very wet; and, therefore, weighed much heavier.

Major Dresser—With your breeze wet it would make a difference in the effective heating power that you would get out of it. It would take so much heat to drive the water out.

Mr. Rollins—We have to use our breeze wet. It is impossible to use it in any other way. If we don't make it pretty wet it blows right through.

Mr. Vanderpool—If you admit too much air, and lower the calorific intensity of your fuel, it will not, of course, do as much work. If you burn it so that it will burn slowly, you will probably get as good results as you would from coke.

Mr. Yorke—Did you discover a greater amount of clinker in the consumption of the breeze than you did in the consumption of coke?

Mr. Rollins—Yes; there was more clinker, and more clinker would come out.

The President—I will ask you to continue the experiment in regard to breeze and coke, and the durability of each under similar conditions; and give us the results some other time.

Mr. Rollins—I shall be pleased to do so.

Mr. Scott—I have an extract from the Massachusetts law in regard to measuring charcoal: and I suppose it will apply to coke. "The measure shall be of cylindrical form, 19 inches in diameter, and 18 1-10 inches in depth, measuring from the highest part to the bottom thereof, each of which shall be deemed to be of the capacity of 2 bushels, shall be filled level full." That makes 5131 inches for the two bushels.

Mr. Coggshall—I would like to inquire of Mr. Lamson if he sells his liquor by the ton?

Mr. Lamson—No, sir; we sell our liquor by the gallon.

Mr. Neal—I don't suppose it is necessary to spend much more time on the discussion of this topic. There is one other subject that, as Secretary, I will bring before the Association; and after that is disposed of other members will doubtless suggest something for us to talk about. A good many of our gas superintendents talk in this way: "I am as economical as I can be in the manufacture of my gas; but I don't see how I can reduce the price any lower than it is now, unless I find some way to increase my consumption."

Now, the question is, how is our consumption to be increased? One way of increasing it has been suggested, and that is by the use of gas for heating and cooking. I would suggest that we now take up that subject and discuss it.

Mr. Lamson—In talking with Mr. Goodwin yesterday he gave me some statements in regard to gas stoves; and, if it is agreeable, I hope Mr. Goodwin will favor us with those statements. (Applause).

Mr. Goodwin—Mr. President and Gentlemen: I do not know that I can say much more as to the economy of cooking by gas than is stated in this pamphlet, which contains a statement of the results of some tests that I made in Philadelphia a few days before the meeting of the American Gas Light Association. Since then there have been tests made by others, among them one that was made at the Cincinnati Hospital. We furnished three number 10 stoves to that hospital, on trial, with the understanding that if the stoves worked as well as the ranges, and as economically, they would be accepted, otherwise, returned.

We sent the stoves to Cincinnati, first requesting that they should be placed on exhibition at the Fair which was about to be held—the result was a silver medal. They were then sent to the hospital for trial. I am sorry that I have not got the statement of the superintendent with me; but as near as I can recollect it was as follows:

They placed the three No. 10 stoves in position as a range. They then weighed the coal used in their ranges, and did their cooking one week on their *coal* range *for* 375 *persons*. The following week they took an equal weight of the same kind of coal and put it into their retorts (as they have a small gas works connected with the hospital) and did their cooking on these stoves for the 375 persons.

They had 490 feet of gas for illuminating purposes left per day to use in the hospital after they had done all their cooking. On the strength of this test they accepted the stoves, gave us the money, and we have spent it. (Applause.) That is one illustration.

You will pardon me, gentlemen, if I bring in a little of the shop in talking about this matter, for I cannot very well help it if I would give you any information of interest. A party in Philadelphia, who was an entire stranger

to me, came into the office one day and wanted to know if we had a stove that would cook for restaurants. I showed him a large one (a No. 12) and he bought it. I told him if it did not work I would take it back. I did not go near him for a month and heard nothing from him. About a month after the purchase I stopped at his place of business one day, and asked him how the stove suited him; he replied—"Well, sir, if I could not get another, I would not take $500 for that stove." (The price of it was $150.) I asked him if he was willing that I should make use of what he had told me; he replied—"This is my name, and place of business; and if any man wants to come and see the stove, and see how it works, he is welcome to do so." At the time I thought, to use a strong expression, that he was putting it on too thick, and I said so, substantially. He replied, "No; I mean it. that stove does its work more satisfactorily than a range. If you could get the gas companies to put down the price of gas, I would like it very much; but, at any rate, I would not take $500 for the stove if I could not get another one like it." A short time after that a plain, ordinary-looking person came into the office. Said he, "I came over from New York to look at your gas stoves." He began talking about some of the largest stoves. I said to him, "Go down to So-and-so, and see Mr. ———, and ask him what he thinks of his stoves." He had seen the stoves at the Fair at the Centennial grounds last October. He went down to this man's place, and came back in about an hour and a half and said, "Put me down for two No. 12, (that was $300), and one No. 11," (that was $75). I began to think he meant business. I do not recollect the gentleman's name, but he keeps several restaurants or coffee houses in New York, and he is using the stoves to his entire satisfaction. I could go on and enumerate instances of this kind, but I merely tell you this to show you that the people are ready for gas stoves if you will put the price of your gas down.

Mr. Neal—To what figure?

Mr. Goodwin—Two dollars a thousand.

Mr. Cabot—There are plently of $2 men here.

Mr. Goodwin—Now as to the consumption of gas by these stoves. That question is often asked me, and I will give you the figures:

No. 0 (which is the smallest) burns about 7½ feet per hour, which is 1½ cents.

No. 1	burns	per	hour	10.8	feet,	which	costs	2.1 cents.
No. 2	"	"		12	"	"	"	2.4 "
No. 3	"	"		16	"	"	"	3.3 "
No. 4	"	"		14.4	"	"	"	2.8 "
No. 5	"	"		21	"	"	"	4.4 "
No. 6 & 7	"	"		30	"	"	"	6.0 "
No. 8	"	"		45	"	"	"	9.0 "
No. 9	"	"		47	"	"	"	9.4 "
No. 10	"	"		50	"	"	"	10.0 "
No. 11	"	"		60	"	"	"	12.0 "
No. 12	"	"		75	"	"	"	15.0 "

Referring to my test in Philadelphia, No. 7 was the size on which the cooking was done, at a cost of 8.17 cents for 1 hour and 50 minutes, which is less than 6 cents per hour.

Mr. Neal—For what pressure are these figures given?

Mr. Goodwin—One inch pressure. If you take 1000 stoves from No. 1 to No. 12, and take into account the proportion of consumption for each stove, it will make 30,000 feet per hour for the 1000 stoves. Now, as to the saving of material in the articles cooked by a gas stove as compared with the same articles cooked by coal on a range. This is something that is not fully understood, and gentlemen sometimes think that we are making extravagant statements. If you take a steak and cook it in the ordinary way over a range, placing it in the broiler, the drippings fall into the fire, and the steak is frequently burned. The first effect of the heat striking the meat is to drive the juices off in a state of vapor. The average loss has been found to be about 32 or 33 per cent. That is to say, if you take a steak or rib of beef and weigh it before broiling or roasting, and weigh it carefully after it has been cooked, you will find that there will be a loss in weight of about 33 per cent. Now, if you place the same weight of steak or rib of beef not *on* a gas stove, but *in* a gas stove, the effect of the heat thrown *down* upon the meat is to cause a covering to form over it. While some of the juices go off in a state of vapor, still there is about 15 per cent. retained in the meat. If any gentleman here has any doubt about this, and wishes to contest the statement, I will send him a stove and he can verify what I have said or disprove it by his own experiments. Then, again, the steak, or whatever you cook in the shape of meat on a gas stove, is a great deal better than the same kind of meat cooked by a range, as anyone will testify who has eaten both. The test that I have spoken of in the pamphlet that has been published, showed a saving of 33 cents in the value, or in the weight, of articles cooked in the gas stove over the same character of articles cooked in the range with coal. The cost of the gas was 8.17 cents, and of the coal, 11.95 cents—call it 12 cents. We saved enough in the weight of the articles cooked to pay for the gas and make a nice little dividend, while the meats were superior in taste, by reason of the juices saved. (Applause.)

Now a word with reference to heating stoves, etc. Just before leaving home I happened to get hold of some data, which I hastily copied, and will refer to, to illustrate what I wish to say. Those who have not paid any particular attention to the matter have scarcely any conception of the loss of energy, or the amount of heat thrown away, in the present mode of consuming fuel, and I think you touched the keynote in your discussion yesterday upon that subject. It is calculated, theoretically, that the amount of coal necessary to develop one horse power is ¼ of a pound. Now, what do you get in practice? The very best condensing engine uses 2 pounds, which is twelve times as much as theory calls for; and an ordinary engine uses all the way from 2 pounds up to 10 pounds. Calculated by percentages, the very best engine that is used to generate steam from coal utilized 9 per cent.—91 per cent. being thrown away or lost; whereas the engine that uses 10 pounds utilizes but 1.8 per cent. These are facts. Some of the gentlemen present are better posted upon this matter than I am, and have given the subject much attention and consideration; if I make a mistake I hope they will correct me. I would ask Mr. Vanderpool as to whether or not these figures are correct?

Mr. Vanderpool—I think your figures, so far as you have gone, are correct.

Mr. Goodwin—Now, turn that coal into gas and what do you find to be the difference. For a gas engine, theoretically, you want 3.66 feet to develop one horse power. Gas engines are now being made that will develop one horse power with 20 feet, and it is stated that some have been made to develop the power with 10 feet of gas by utilizing some of the heat to generate steam. Put these into percentages, and you have something to show you the difference between gas and coal as applied to the question of heat. You realize from 18 to 36 per cent. from the fuel turned into gas and converted into power, using a gas engine that consumes from 10 to 20 feet per horse power.

Now, take the same amount of coal and turn it into gas, and consume it in a gas stove, and you get very nearly the same per cent. But here arises a difficulty that it is very hard for me to get people to understand. If you have a gas stove for cooking they are so constructed that the products of combustion of the gas will come out in the room. Any person who says that he can furnish a gas stove that does not need a pipe to carry away the products of combustion, makes, I think, a wrong statement. It is, at least, a mistake; but as soon as you connect the stove with a flue, off goes a portion of the heat. A party once made a complaint to me that a smell of gas came from his stove. I told him he needed a pipe to carry off the products of combustion. He then had a pipe put to his stove. A short time after that he sent for me to come and look at it, as it did not work to his satisfaction. I went and found that, with a small-sized stove, he had about 35 feet of pipe to reach a window. What was the consequence? He had a large surface for condensation, and the result was that he had the finest specimen of a smallpox pipe that you ever saw. The gas consumed was of course condensed into water, and he wanted to know where that water and rust came from. (Laughter.) If you have a short pipe some of the heat is carried off, and if you have a long pipe the gas consumed is condensed into water and the stove rusts. You can't have everything just as you want it. So, you see, this question of heating by gas presents some difficulties with all its advantages. I have made some experiments that I haven't much to say about just now, only to mention, in passing, that in the way of heating, by the use of hot water, I have obtained some very good results in that direction. If I live until another year I hope I shall be able to say something of value to the gas interest in that way. Upon the question of gas engines. I have a *two man* power gas engine in my establishment, and I have obtained from it some very satisfactory results.

Mr. Neal—My experience has been, and I think it has also been the experience of Mr. Gerould and some others, that where the day pressure is about an inch, gas stoves that have been sent out have been returned, and the reason given for returning them has been that there was not pressure enough.

Mr. Goodwin—Every one of our stoves are tested and adjusted to one inch pressure at the stove, so that it won't consume over half a foot, more or less than the standard, and that the stove, when put together, will consume about the quantity I have given you.

Mr. Vanderpool—Can a stove be made to work under a less pressure than an inch at the stove?

Mr. Goodwin—Certainly; but you have got to have some standard to start from to meet the general pressure. Therefore, one inch is our starting point. We could get them down to half an inch.

Mr. Vanderpool—Could you get as good results by using half an inch pressure?

Mr. Goodwin—We have made stoves to burn gas at half an inch pressure

and have obtained some very good results; but I have never made a thorough test at that pressure.

Mr. Vanderpool—Is it your impression that you could get as good results from a stove working under half an inch pressure as you could from one working under an inch pressure?

Mr. Goodwin—I think so.

Mr. Neal—How do you answer the objection that the stoves are returned in a great many instances, and that the reason given is that there is not pressure enough, when the pressure is an inch?

Mr. Goodwin—I would answer that by saying that I don't think they had anything like that pressure; there must have been a mistake.

Mr. Stiness—Mr. Neal has spoken about Mr. Gerould having stoves returned. I think he is mistaken about that, for my impression is that Mr. Gerould has told me to the contrary.

Mr. Gerould—I have never had but one stove returned, and that burned too much gas.

Mr. Goodwin—The great difficulty is that when the persons who are using the stove get through they do not turn off the gas. We got up a sort of a double back-action contrivance that would always turn down the gas the moment a pan or utensil was lifted from the stove and would turn it on when the pan or utensil was set on the stove; but that added to the expense and the gas companies were always saying, "You charge too much for your stoves; they are too expensive." You see where I am drifting to now, and I want to say a few words upon that point right here.

A gentleman, at the head of a large gas company, and whom you all know, called at my office one day and we had a long conversation on this subject. During our conversation he said, "You charge too much for your stoves." I said to him, I will tell you what I will do; I will give you the cost of my stoves, and you shall name the price; the result was the present price. We introduced several thousand dollars worth of machinery in our establishment in order to reduce the expense of manufacture; but we had no sooner done so than the price of iron went up to such a figure that the advantage was entirely lost. Take, for instance, the foot of the stove. Where a man could make one dozen a day before, we have machines now by which he can make over 100 a day; but, as stated, we have lost the benefit of that by reason of the rise in the cost of materials. Wherever it is possible to introduce machinery we have done so.

In reference to this stove question, I will say that five years ago I bought a sample of every gas stove made in this country that I could get hold of, and I found they were not what was wanted—in my judgement. I tried in every direction, but could not get what I felt was wanted. I then sent one of my employees to Europe, and told him to travel in every direction where he could get any information. I kept him abroad five months, visiting England, France, Germany—everywhere that there was any information to be had; and he brought home all the information he could collect, as well as samples of the best gas stoves he could find.

Last year I sent another person abroad, and he was gone several months. He brought home all the information he could obtain, and other samples; and these stoves are the outgrowth of that investigation.

Mr. Harbison—What kind of coal did they use in the Cincinnati hospital where those tests were made?

Mr. Goodwin—The regular gas coal such as they use in the gas works there. They use nothing else in that part of the country but soft coal.

Mr. Neal—There is a gentleman present, Mr. Scott, who uses a gas stove every day in the year. Perhaps, he will favor us with his experience.

Mr. Scott—My stove is a retort stove. My family is small, and we use a gas stove every day, and find it economical, convenient, and very satisfactory.

Mr. Vanderpool—Mr. Goodwin asked me about the correctness of some figures that he gave in reference to the utilization of energy.

It is well worthy of consideration that the efficiency of gas engines, as evinced by their conversion of heat units into work, is very high. The consideration of this fact, and their successful running, have drawn the highest engineering journals to express the opinion that their adoption for light or intermittent work is certain, and a mere question of time. It is probable that, with increased attention (there having been but comparatively little investigation in this direction) the gas engine will be much improved, and the consumption of gas will be reduced below 20 cubic feet per horse power per hour.

As just stated, the most perfect engines using at the rate of two pounds of coal per horse power per hour, convert into power about nine per cent. of the energy of the coal; whereas, an engine using at the rate of 10 pounds utilizes less than 2 per cent. A cubic foot of 16 candle coal gas has a calorific power of about 660 heat units; and if 20 cubic feet produce a horse power it is evident, the thermal equivalent of a horse power being 2565 units, that the utilization of energy is 19.3 per cent. The efficiency of the gas engine, as thus considered, is more than twice that of the best steam engine. There is another way of looking at this question; if we take one ton of coal, carbonized in the best manner, the weight of the ton actually used, in gas, coke, and waste, to produce 11,200 cubic feet of gas is 778½ pounds, and there should be left, of salable residuals, in the shape of coke, tar, and liquor, 1461½ pounds. The yield of gas per pound of coal, actually used, is evidently 11,200÷778.5=14.4 cubic feet. As 20 cubic feet of gas makes a horse power, we have one horse power produced by 20÷14.4=1.38 pounds of coal. If the gas engine is so perfected that 10 cubic feet of gas produce a horse power, as has been claimed by some engine builders (but these figures require verification) it is evident we will obtain one horse power by the consumption of less than three-quarters of a pound of coal. The theoretical consumption of 16 candle coal gas per horse power is 2565÷660=3.88 cubic feet. Some interesting calculations upon these matters, bp Mr. Lane, may be found in recent issues of *Engineering*.

There are evidences of a large demand for the gas engine in this country. I was informed recently, in a conversation with a representative of a certain engine, that there were unable to supply the demand, and that there were already in operation, in the city of New York, thirty of these engines that had been erected within a short time, and without particular solicitation on the part of the builders. It also appears that there is a large and increasing demand for gas stoves for cooking.

The indications are that, with proper attention on our part, we can largely increase our day consumption, which we know is of great importance, as bringing into use plant that lies comparatively idle during most of the 24 hours, and an increased consumption on the same capital means the capacity to sell at lower prices.

[To be continued.]

Spence's Metal—A New Metallic Compound.

We insert below a condensed report of Dr. Cole's lecture on this new metallic compound, read before the Society of Arts at a recent meeting, and followed by an interesting and useful discussion:

DISCOVERY OF THE METAL.

Nearly a year ago Mr. J. Berger Spence discovered that the sulphides of metals, combined with molten sulphur, formed a liquid. This liquid, on cooling, became a solid, homogeneous mass, possessing great tenacity, and having a peculiar dark grey—almost black—color. Nearly every metallic sulphide which is known combines, as experiments have proved, with an excess of sulphur, and curiously enough, all these combinations have the same properties. The combination, of which I have specimens here for inspection, consists of an ore of iron pyrites containing both lead and zinc sulphides.

CHEMICAL COMPOSITION.

Dr. Hodgkinson, chemical demonstrator at the Science Schools, South Kensington, has kindly sent me the following facts:

"It appears to be the easiest thing in the world to obtain homogeneous castings with it. Specific gravities of portion sent gave 3.3743 to 3.7036 (reduced to 0° C).

"When finely powdered, it is acted upon slowly by concentrated HCl and NO_2HO in the cold; in large lumps, little or no action takes place. As yet I have not been able to determine the expansion equivalent accurately; it would appear, however, to be small. The fracture is not conchoidal, as might perhaps have been expected, but somewhat like that of cast iron.

"I have not had time to try many 'utilization experiments' on the substance, but I have no doubt it would be exceedingly useful in the laboratory, even, for instance, for making the air-tight connections between glass tubes by means of caoutchouc, and a water or mercury jacket, where rigidity is no disadvantage; the fusing point is so convenient, about 340°, that it may be run into the outer tube on to the caoutchouc, which it grips on cooling like a vice, and makes perfectly tight.

"I don't know what you may call the material, but should think, as it seems to be more than a mere mixture, 'ferric thiate' would not be a bad or inappropriate name."

PROPERTIES OF THE METAL.

It has a comparatively low melting point, viz., 320° Fahr., or rather more than 100 above the temperature of boiling water. Here, then, we have in its favor the small amount of fuel needful to supply the necessary heat for reducing the metal to a condition for use.

2. It expands on cooling, a property not shared by the majority of other metals or metallic compounds. I believe that type metal and bismuth are two exceptions. Later on I think I shall convince you that, for an operation like the joining of gas and water pipes, this expanding property is one of great importance.

3. It claims to resist atmospheric or climatic influences, as compared with bronze and marble. I noticed only a few days ago how the statues in bronze on the Holborn Viaduct, had been affected by our London fogs. And I have evidence to produce in the direction of showing the imperviousness of the metal to such degrading influences.

4. As compared with other metals or metallic compounds, its resistance to acids, used commercially, to alkalies, and to water is certainly superior.

5. A smooth surface of this mineral or metallic compound, now known commercially as Spence's metal, takes a very high polish. I will illustrate this to you by casting some of this molten metal on to a surface of glass.

ITS USES TO ART.

The advantages which Spence's metal possesses over other materials used for artistic productions may be summarized under three heads:—1. Cheapness. 2. Facility of working. 3. Resistance to climatic influences.

Cheapness.—As compared with lead, which is one of the cheapest of metals, it is one-third the weight; and, whereas the average cost of lead for the last ten years has been £18 a ton, Spence's metal only costs £15. A ton of Spence's metal being three times the amount in bulk of that of a ton of lead, it is available for three times the amount of work. It may, therefore, be considered to be nearly a quarter of the price of lead, and, consequently, very considerably less than that of bronze.

Facility of working.—Its melting point being very low, it can be easily prepared for pouring into a mould, and its property of expanding, when cooling, causes it to take such a perfect impression that the cast requires very little chasing after. In respect of a gelatine mould which can cover a considerable surface of works without joints, such as one has to make in plaster piece moulding, the metal cast obtained from such a mould would require no chasing whatever.

Resistance to the Atmosphere.—With regard to its resistance to climatic influences, experiments have been conducted in this direction with complete success. A polished surface of the metal has been exposed for six months in all weathers, without showing the least change.

Mr. Wood, the Secretary of this Society, has had a medallion, which I sent him a month ago, exposed to all the recent fogs and frosts, on the outside of this building. You can judge and see for yourselves how well it has stood this test.

INDUSTRIAL USES.

I propose to divide these purposes under three heads :—I. Gas and Water Works. II. Chemical Works. III. Miscellaneous.

Gas and Water Works.—As practice is better than theory, I will simply relate, as best I can, those experiments which have been tried at the South Metropolitan Gas Works. Experiments, under the direction of Mr. Livesey, were made some weeks back; two pipes were joined by this metal in much less time than would have been taken had lead been employed. The pipes, after having been joined, were tested under pressure, but no leakage was found.

Method of Jointing Pipes with Lead.—In order to show the special advantages this metal has over lead, it will be as well here if I endeavor to tell you how gas or water pipes are joined when lead is used. The pipes having been laid together the joint is packed with yarn; clay is then laid round the exterior of the joint, and the molten lead is run in. Unfortunately, lead possesses the property of contracting on cooling. The leaden joint has, therefore to be "caulked," or, as it is called in the north, staved. This caulking, or staving, means wedging the lead into the joint, in order to obtain a perfectly tight join. This caulking naturally occupies considerable time, and necessitates excavation, in order to allow the men to work all round the pipes.

Excavation and caulking are both rendered unnecessary by the use of Spence's metal. The pipes have only to be laid together, and after the yarn has been forced into the joint and the clay placed, the liquid metal is run into the joint, the clay is removed, and the joint is finished. The metal does not splash in running into the mould, thus avoiding a great source of waste of material, and danger to the workmen.

Experiments were also tried to test the metal joints in the event of subsidence of the ground. Four lengths of nine feet piping, six inches diameter, were joined with the metal, and supported on trestles. After the metal had set, which it did in a few minutes, the centre supports were knocked away, leaving only the two end ones. The thirty-six feet length of piping sank seven inches, without showing, even after pressure, a leakage.

These experiments were so satisfactory, that the South Metropolitan Company have adopted the metal, and are now laying their pipes with it. Mr. Livesey, the chief engineer, in writing on the subject to Mr. Spence, says: —"We have now only the test of time, and that, I think, we may take the risk of." Others of the London gas works, and a very large number of provincial gas works, are adopting it.

In the same way, it will be useful for water works. Mr. Hope, who undertook some experiments in Scotland, reports that at the Edinburgh water works two pipes were joined, and subjected to a pressure of 400 feet of water, (which was as much as they could get on) without the joint showing any leakage. This is the greatest pressure which we have as yet been able to put it to; so what it will actually bear I am not at present in a position to say.

From a sanitary point of view, as water has no action on the metal, it would be extremely valuable for cisterns, instead of iron or lead; being almost a non-conductor of cold, pipes might be lined with it to prevent the water from freezing.

Uses to chemical Works.—The metal being less acted upon by acids than other metals, it may also be of service to chemical manufacturers. I refer especially to sulphuric acid, which is the most especially used of all acids in commerce. Lead has, up to the present, been used for sulphuric acid, and its action is almost imperceptible. The one objection to the use of this metal in this case is its low fusing point, but when acids have only to be used up to a certain temperature, say 200° F., I venture to predict a large field for its use.

DISCUSSION.

The Chairman said Dr. Cole had certainly proved that there was in one way or other a very large field for the employment of this new metal. This metal was already in profitable use for joining gas and water pipes, where it possessed considerable advantages, not merely because lead required wedging in, in order to make a tight joint, but very often, from the difficulty of getting at the under side of the joint, it was imperfectly accomplished; whereas this metal, from its fluidity, penetrated all round, and so made a good piece of work of it. Lead poisoning was another thing which naturally occurred to one, and if this could be used as a coating for pipes, or for the material of pipes, if not too brittle, it would have the double advantage of preventing the decomposition of the lead, and also the possibility of freezing.

Mr. Livesey said he had had some experience in regard to joining gas-pipes, and he would state the result. Lead was most unsuitable for this purpose in some respects, though it was universally used. It was expensive; it required caulking or setting up to make it tight, because it contracted in cooling; and, if you wanted to remove the pipes—which constantly happened, except in the largest mains—from the increased consumption requiring larger pipes, the use of lead prevented your getting out the pipes without cutting them, which occasioned considerable loss. Various means had been tried for drawing pipes, but all had failed, and they always had to be cut. Another drawback was that lead, being valuable and easily disposed of, was constantly being stolen. Now, this new metal was free from all these disadvantages; the only thing which occurred to him, while listening to the paper, was that it seemed a shame to put so beautiful a substance to so base a use; for when he looked at those beautiful busts, it seemed a pity to use the same material for joining gas mains. However, it had many advantages for this purpose, not the least of which was its perfect soundness. The account given by Dr. Cole was quite accurate. The four pipes jointed in the Old Kent Road, as described, and supported at the two ends, were exposed to the most severe test, and when he purposely broke one of the joints at the conclusion of the experiment to see what the effect was, he found the metal had taken a perfect impression of the cast iron. The South Metropolitan Gas Company were now using it instead of lead; the men had no difficulty in applying it; and the only test required was that of time, of which he had no fear. The only possible difficulty was that workmen, being accustomed to use a fierce fire to melt the lead, might make the metal too hot, and so burn the sulphur; but that could easily be guarded against. If required, it could be easily cut out with a chisel in order to remove the pipes; and another advantage was, that if from any cause it did not run quite round a large pipe and make a perfect joint, you could clean out the part which had not been filled, put a fresh piece of clay there, and fill it up with a little more metal, and thus the joint was made quite sound.

Mr. Cresswell wished to ask one or two questions, not with a view to throw a doubt on the utility of the invention, but rather to elicit valuable information. He wished to know, in the first place, if this material, when used for jointed pipes, possessed any elasticity; because he was told that it was absolutely essential to the permanence of gas pipes under the London streets, with heavy traffic passing over it continually, that there should be a certain give and take, or elasticity in the joints. If, when heavy pressure was brought to bear on these pipes, they gave way at the joint, the value of the joint was reduced to *nil*. In the ordinary way, you first caulked the pipe, then filled it with lead, and then caulked the lead, and thus produced an elastic joint which would yield to such an extent that you might bend the joint without destroying the continuity of the joint. If, on the other hand, this metal was so brittle, that under any sudden pressure it gave way, it would be a formidable difficulty. The next question was this. He understood there was a project for bringing salt water to London from the sea, and one of the greatest difficulties, as he was informed, which the promoters would have to deal with, was to discover a joint for the pipes which would not be affected by the salt water. If any means could be devised for cementing pipes which would allow of salt water being conveyed from Worthing to London, and remaining in the pipes for 48 hours or more, or even

permanently, it would relieve the promoters of this enterprise of a great difficulty, and perhaps confer a great boon on the inhabitants of the metropolis.

Mr. Waller asked if it would expand and contract in the same proportion as water pipes, if used for hot water?

Mr. Spence said the joints would be considerably affected by hot water if the temperature were very high. Ordinary boiling water would not affect it; but, as it melted at about 300°, if there were a steam pressure of about 40 lbs. there would be such an increase of temperature that the joints would not stand. It did possess a certain amount of elasticity. In one case 30 feet of pipes were connected with this metal at the joints, and deflected to the extent of eight inches, and, when the weight was removed, the pipes recovered their original position, showing that it was elastic to some extent. With regard to expansion and contraction, he was hardly yet in a position to speak. He would take this opportunity of stating that if ever that metal (as it was called) did take a place in art or industry, much of its success would be due to Dr. Cole, who had greatly assisted him in his experiment, and in elucidating the facts; and also to Mr. Livesey, who was the first to take it up in a practical way.

Mr. Livesey said lead was certainly not elastic; if you were to join four lengths of nine feet together with it, caulking it up in the ordinary way, and then knock out the central supports, the upper part of the joints would squeeze into a narrow compass, and the lower would be left open, and when the pipes were again brought to a straight line, the lead would not return to its original shape. Lead was not elastic in any sense whatever, and it was, therefore, a very bad thing for pipes, where there was any settlement or change of position. This metal seemed to have the effect of making the four lengths into one continous, perfect pipe, which had just the same strength in the joints as anywhere else. This was shown by the fact that when supported at the two ends it sagged evenly throughout, making a continuous curve, whereas, if the joints had been made with lead, there would have been a number of straight lines, with angles at the joints.

Dr. Cole said he believed that salt water would havo no action on the metal whatever. The same with regard to galvanic action, for which it had been tested. He would conclude by another experiment, to show how quickly the metal set, namely, coating a pat of butter with it.

While the experiment was being performed,

The Chairman proposed a cordial vote of thanks to Dr. Cole, which was carried unanimously.

Coal Fields of Colorado.

In the southern part of La Plata County is an immense coal field, which extends from the valley of the Rio Los Pinos to the southeast end of Ute Mountain. This field is in sandstones and shales of the cretaceous age, divided into the upper and lower measures, about 1,000 feet apart. The lower coal measure is in a zone of shaly sandstones that are about 300 feet thick, and the coal is intermixed with shales and other impurities that render it worthless; but when separated from the shale, it is of excellent quality for domestic use. The lower measure is underlaid by a bed of dark gray shale, containing calcareous seams and nodules called septaria. The La Plata coal bed is located on a bed of whitish sandstone. It extends from the east end of the county for 60 miles, and is crossed by the Animas River. The thickness of the entire bed between the floor and the roof is over 50 feet, and contains about 40 feet thick of good coal free from shale. The floor, of grayish white sandstone, is covered with a thin layer of clay and clay shale, varying from an inch or two to a thickness of two feet. Upon this a layer of compact, firm coal, six to eight feet thick; then a layer of tough black shale, 1½ to two feet thick; upon this is a bed of excellent coal over 30 feet thick, with only small seams of shale at intervals of four to ten feet. The "roof" is a tough, shaly sandstone, alternating with true shales for a distance of several hundred feet above the coal bed. In this overlying formation there are two or three small veins of coal, one of which is large enough for exploration,

The quality of the coal has been tested in a crude way by coking it in pits and heaps, and by use in blacksmiths shops, stoves, and in open fire places, in all of which it gives good satisfaction. It is strongly bituminous, cinders well, and forms masses of coke in an open fire. It is exceedingly rich in gaseous products, takes fire readily and burns freely, leaving a brownish gray ash.

The working of these beds will be confined to the outcrop at the most convenient points where levels can be run for years. Its location will undoubtedly prevent it from being of any great commercial value; still it will prove to be a mine of inexhaustible wealth to La Plata and San Juan counties, in consequence of its coking qualities, and adaptability to all kinds of metallurgical, mechanical and domestic uses. The material interests of San Juan and La Plata counties are inseparably interwoven by the drainage system of the San Juan River, the physical features of the country, and their mutual dependence on each other in many ways. San Juan has an abundance of the precious and useful metals, but can produce no food for her population. Her lowest mining camps are over 9000 feet above the sea, and the highest peaks have an altitude of over 14,000 feet. La Plata raises vast quantities of meat, vegetables and grain, and supplies all demand for lumber, timber, coke, and coal; but were it not for San Juan's needs, La Plata would have no market for anything, save cattle that could be driven to distant markets.—*La Plata Miner.*

Third Quarterly Meeting of the Central New York Gas Engineers Association.

[The continuation of the proceedings of the last meeting of the above-named Association came to hand too late for publication in the present issue.—Ed.]

Meeting of the Gas Corporation Committee of Birmingham England.

The Meeting of the Gas Committee of the Corporation of Birmingham took place on the 16th ult., to whom the Chairman of the Committee, Mr. Alderman Chamberlain, delivered a very lengthy but interesting report. Since the purchase of the Birmingham Gas Works by the Corporation, some extensive alterations have been made in some of their works, and additional plant has been erected. The sale of gas for the year has been 2,645,396,200 cubic feet, or an increase of 150,900,300 cubic feet during the corresponding period in the previous year. This probably does not show an enormous increase in such a large town as Birmingham, when we compare the figures with some other towns, and we can only attribute it to the non-reduction of the price charged. The Chairman, is, however, of opinion that during the next four years the consumption will show an increase of 26 per cent. And here we would observe, no means of effecting this object can be better attained than in extending the use of such apparatus as will tend to a larger consumption of gas. We note that during the past year the number of gas cooking and heating stoves, gas fires, etc., amount to nearly eight hundred, supplied by the corporation to their customers on sale or hire. This is very satisfactory, and we are assured, if this department of the Committee continue to extend its business, a very largely increased sale of gas will be effected, which means additional profit to the corporation. We cannot close this brief notice without congratulating the officials of the gas commitee, and their able engineer, Mr. Hunt, upon the management of such extensive works as those now owned by the Birmingham Corporation.—*The Gas Engineer.*

Caution.

Office of the N. Y. & N. J. Globe Gas Light Co., Limited,
152 B'way, New York, Contractor for Lighting Streets.
New York, March 27, 1880.

To the American Gas Light Journal—

We desire, through your columns, to caution gas companies and others against negotiating with unauthorized persons for the purchase or lease of our patents. We are led to this announcement from information we have received to the effect that unscrupulous persons claiming to represent us have endeavored to "strike" gas companies, by threatening to bid for lighting street lamps "unless the gas company comes down." To such practices we offer our serious condemnation. While reserving the right to honestly compete for lighting streets in a regular, business-like way, we shall never be found aiding or abetting blackmailing schemes.

We should be glad to receive notice of any such attempt made, claiming to be authorized by us; and assure the fullest co-operation on our part to prevent it.

We caution all gas companies against purchasing, or leasing, any vapor burner, having—

A water-trap.
A return-jet, for heating purposes.
A metallic packed-tube.
A device for oxygenizing the vapor.
A chamfered-end tank,

all of which are indispensable to the proper working of a vapor burner, and are all covered by letters patent owned by us.

We are always glad to respond to any legitimate inquiry made by a gas company, and will gladly assist in preventing the trespass of persons who seek to bring a respectable business into disgrace.

Very respectfully,
The N. Y. & N. J. Globe Gas Light Co., Limited,
Nicholas R. Connor, *Secy.*

—*Adv.*

THE AMERICAN GASLIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS
SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS
NEW YORK—AMERICAN NEWS Co., 39 and 41 Chambers St
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 22 Buckingham St., London, W. C.
Germany—B. WESTERMANN & Co., of New York

FRIDAY, APRIL 2, 1880.

Official Report of Examinations of Gas for three Weeks ending Mar. 27, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Mar. 1880.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		*	*	†	*	*	†
8		19.53	18.42	29.18	19.91	17.99	30.63
9	Between 9.30 A.M. and 1 P.M.	20.43	18.70	29.37	19.38	18.16	31.44
10		18.52	18.16	29.68	21.06	17.32	30.16
11		18.22	18.08	27.46	20.75	17.41	29.81
12		18.27	18.10	27.26	19.72	17.41	29.70
13		18.84	19.10	29.72	19.89	17.25	29.32
	Average	18.97	18.42	28.78	20.12	17.59	30.17
15		17.56	18.10	28.16	19.89	17.13	28.58
16		18 84	18.06	26.75	19.83	16.87	27.04
17		19.34	17.58	27.08	20.80	17.68	27.97
18		17.98	18.97	27.51	21.14	17.49	28.69
19		18.07	18.82	27.26	21.06	17.53	28.60
20		19.15	18.63	27.11	20.94	17.25	28.86
	Average	18.49	18.35	27.31	20.61	17.32	28.29
22		18.63	19.34	26.54	19.15	17.08	30.66
23		18.75	18.67	26.57	19.79	17 56	30.67
24		18.48	19.06	26.54	20.51	18.32	30.58
25		18.49	19.07	27.65	20.60	17.77	30.70
26		19.11	18.60	27.90	20.56	17.58	29.80
27		18.21	18.63	27.68	20.22	17.61	28.99
	Average	18.61	18.89	27.14	20.14	17.65	30.13

* Five foot lava tip with check.
† Bray's slit union, No. 7.

E. G. LOVE, Gas Examiner.

Bids for Lighting Public Lamps in New York City.

The following are the prices which were bid by the different companies for lighting the street lamps in this city for one year, from May 1, 1880 (4000 hours), in accordance with forms and specifications furnished by the Department of Public Works:

Company.	Gas.	Lamp-Post straightened.	Column reloaded.	Column refitted.	Lamp removed.	Lamp reset.	New Lamp fitted up
Manhattan	17 00	1 50	1 50	3 50	3 50	10	10
New York	17 00	1 50	1 50	3 50	3 50	10	10
Mutual‡.....	19 75	1 50	1 50	3 50	3 50	10	10
Municipal.....	20 00	1 50	1 50	3 50	3 50	10	10
Metropolitan‡ ..	19 50	2	2	3	3	8	8
Harlem.....	17 70	2 50	2 50	3 50	3 50	8	8
Yonkers.....	30 00	1	1	2 00	1 50	8	10
N. Y. and N. J. Globe gaslight Company ‖.....	16 00	1 50	1 50	3 50	3 50	10	8

‡ Schedule.
‖ Naphtha lanterns; bid for 2000 lamps north of 79th street.

The specifications this year call for cleaning the lamps three times a week instead of twice; for supplying, after their first application, the red glasses called for by the resolution of the Aldermen requiring red glass on the top of lanterns near fire alarm boxes; and for doing all the lighting, extinguishing, painting, and repairing.

The Gas Commission met on March 30 and rejected all the bids, because the sum total of all the lowest bids exceeds the appropriation of the Board of Apportionment. The increase in price bid was from $12 to $17 for the New York and the Manhattan, $19 to $19.75 for the Mutual, and from $18.28 to $19.50 for the Metropolitan. About $20 is a fair price.

An Improved Process of Manufacturing Coke.

Mr. A. M. Chambers, of the Thorncliffe Collieries, near Sheffield, has patented a process of manufacturing coke which is stated to be of very great importance to coke manufacturers. Mr. Chambers' invention is of a very simple character. Instead of allowing the draft to go over the burning coal at the furnace door, Mr. Chambers builds up the furnace door entirely, and drives in hot air, by means of a pipe, over the face of the coal in a direct line to the exit flue. By this means the products of combustion pass from the oven to the main flue or chimney; a greater draft is thus secured, a quicker make of coke obtained, and the sulphur almost entirely got rid of.

Mr. Chambers claims for his invention the following advantages: At least 15 per cent. more coke from the same quantity of coal, a much larger quantity of coke per week in the same number of ovens; the almost complete riddance of sulphur; a much denser coke with less breeze and dust, and free from black ends; a considerable saving in the cost of cooking, and its easy application to existing ovens.

The engineer states that at Westwood the patent has been applied to about 70 coke ovens with excellent results.—*Iron Age.*

Lamp Wicks Made of Glass.

A new kerosene and spirit lamp has been invented in which the wick is made entirely of glass. Several advantages are claimed for it. The flame clings closely to the wick, so that lighted lamps may be carried about without fear of their being extinguished by sudden drafts; moreover, no sparks are liberated from it. With an equal amount of this wick turned up, a much brighter and clearer light is obtained than where cotton ones are used. The smoking is greatly reduced, and at least ten per cent. of oil is saved. There is scarcely any waste of the wick itself, and the troublesome trimming and cutting to which lamp burners are accustomed are altogether needless, for no portion of it is carbonized. Used in a spirit lamp, it greatly increases the heat of the flame; and, finally, it is claimed that it can be produced and sold at a cheap rate.—*Pottery Journal.*

Tides in Place of Coal.

At the last meeting of the Liverpool Engineering Society a paper was read touching the probable exhaustion of coal, in which the author advocated the substitution of the tides as a producer of motion, which would outrival all other sources of mechanical power. A correspondent of the *Builder*, too, is of the same opinion. A compressed air chamber, filled by the tide at Brighton, for instance, would, he is confident, run an atmospheric railway, such as Brunel invented, from that place to London.

If the tides could be thus utilized, all our railways and factories—all the work now done by the steam engine—could be performed by them. There would, moreover, be no jerk, no steam, no smoke, no noise. Apart from the fact that the present generator of steam will in time cost more to produce than it is worth, coal has so many disadvantages that no one will regret to see the time when it will be supplanted by another agent. When this is to be, is the question of the future.—*Exchange.*

Oil Tank Explosion in Brooklyn.—An oil tank containing over 100 barrels of oil exploded yesterday morning at Pratt & Company's oil works, on Bushwick Creek. The tank burst in two pieces, one portion of which tore down forty feet of fence, and the other was blown into the creek.—*Union-Argus*, Nov. 20.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
24 PINE STREET, NEW YORK CITY.

APRIL 2, 1880.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid.	Asked.
Gas Co.'s of N. Y. City.				
Central.....	466,000	50	50	60
Harlem.....	1,800,000	50	50	60
" Bonds	170,000			103
Manhattan.....	4,000,000	50	173	178
Metropolitan.....	2,500,000	100	127	132
" Scrip ...	$1,000,000	...	99	102
Mutual.....	5,000,000	100	68	72
" Bonds, go'd	900,000	1000	95	100
Municipal.....	1,500,000	100	185	200
" Bonds	750,000		106	110
New York.....	4,000,000	100	100	102
Northern.....	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	116	120
Citizens.....	1,200,000	20	55	60
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal.....	1,500,000	100	94	97
Peoples.....	1,000,000	10	25	30
" Bonds.....	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan.....	1,000,000	100	60	70
Nassau.....	1,000,000	25	50	55
" Ctfs.....	700,000	1000	85	95
Williamsburgh	1,000,000	50	75	80
" Scrip		...	98	103
Kings Co.....	135,000	100	—	50
" Bonds.....	40,000	—	—	—
Union Co. E N. Y...		25	—	50
Richmond Co., S. I.	300,000	...	70	80
Out of Town Gas Companies.				
Bath, Maine.....	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100

Baltimore, Md.....	2,000,000	100	95	98
" Ctfs., gold	1,000,000		—	103
Bayonne, N. J.....		100		90
Brockport, N. Y.....	25,000	100	...	80
Citizens, Newark.....	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Derby of Conn.....	160,000	100	60	80
East Boston, Mass...		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.....		100	...	—
Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	120	125
Hempstead, L. I.....	25,000	100	...	—
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
Jersey City	750,000	20	140	145
Jamaica, L. I.....	25,000	100	...	—
Jacksonville, Ill.....	120,000	50	100	...
Lewistown Maine...	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	93	96
Long branch		20	30	40
New Haven, Conn...		25	120	140
Peoples, Jersey City		...	40	50
" " Bds.				95
Peoples of Albany...	650,000	100	—	10
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	80	84
" Bonds....			106	—
Plainfield, N. J.....	80,000	100	—	105
Perth Amboy		25	—	95
Pittsfield, Mass.....			120	130
Rochester, N. Y.....		50	70	80
" Citizens		100	50	60
Rondout & Kingston			75	80
St. Louis Missouri..	600 000	50	300	—
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
San Francisco Gas Co., S. Fr'isco Cal.			81¾	82
Toledo, Ohio.....			95	97
Troy, Citizens.....	600,000	100	—	—
Washington, D. C...	1,500,000	20	170	185
" Scrip	500,000	20	100	110
Woonsocket, R. I....	150,000	100	80	...
Wilmington, Del....		50	174	...

20 shares Manhattan sold at auction, March 31, at 173.

Advertisers Index.

GAS ENGINEERS.

Page.

William Farmer, New York City..... 166
George W. Dresser, New York City..... 159

GAS WORKS APPARATUS AND CONSTRUCTION.

Herring & Floyd, New York City..... 163
T. F. Rowland, Greenpoint, L. I..... 163
J. W. Starr & Son, Camden, N J..... 163
Delly & Fowler Philadelphia, Pa..... 163
Kerr Murray, Fort Wayne, Ind..... 163
George Stacey & Co., Cincinnati, Ohio..... 163
Bartlett, Robbins & Co., Baltimore, Md..... 163
Morris, Tasker & Co., Limited, Phila., Pa..... 159
Monongahela Gas Works Mfg. Co., Pittsburgh, Pa 164
Brown & Owen, Phila, Pa.. 163

GAS AND WATER PIPES.

McNeals & Archer, Burlington, N. J..... 162
Gloucester Iron Works, Philadelphia, Pa..... 162
Robt. Campbell & Co., New York City.. 162
James Marshall & Co Pittsburgh, Pa..... 162
R. D Wood & Co., Philadelphia, Pa.. 162
S. Decatur Smith, Philadelphia, Pa..... 162
Warren Foundry and Machine Co..... 162
Pancoast & Tarr, 99 Platt Street, New York City..... 159

PIPE CUTTING MACHINES.

A. C. Wood, Syracuse, N. Y. 135

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J..... 160
B. Kreischer & Sons, New York City..... 160
Adam Weber, New York City..... 160
Laclede Fire Brick Works, St. Louis, Mo..... 160
Brooklyn Retort and Fire Brick Works..... 160
Borgner & O'Brien, Phila., Pa..... 160
Gardner Brothers, Pittsburgh, Pa..... 160
Henry Maurer, New York City..... 158

DIETERICH'S REGENERATOR FURNACE.

Chas. F. Dieterich, Baltimore, Md... 144

GAS METERS.

Harris, Griffin & Co., Philadelphia, Pa..... 166
American Meter Co., New York and Philadelphia, Pa. 167
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa167
Harris, Heime & McIlhenny, Philadelphia, Pa..... 167

GAS STOVES.

The Goodwin Gas Stove and Meter Co., Phila., Pa. ... 168

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y..... 161

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind.. 161
Smith & Sayre Manufacturing Co., New York City..... 161

GAS COALS.

Penn Gas Coal Co., Philadelphia, Pa..... 165
Perkins & Co., New York City.....164 165
Cannelton Coal Co., " " " " 165
New York & Cleveland Gas Coal Co., Pittsburgh, Pa.... 165
Newburgh Orrel Coal Co., Baltimore, Md..... 165
Despard Coal Co. Baltimore, Md..... 165
Tyrconnell Coal Co., Baltimore, Md..... 165
Fort Pitt Gas Coals..... 165
West Fairmont and Marion Coal Co., N. Y. City..... 165
British Cannel Company, Manchester, England..... 164
Montauk Gas Coal, New York City. 164
Ellis Lever & Co., Manchester, England. 164

GAS ENGINES.

Schleicher, Schumm & Co., Philadelphia, Pa..... 135

STREET LAMPS.

J. G. Miner, Morrisania, N. Y. City.... 164

BURNERS.

C. Gefrorer, Philadelphia, Pa..... 159

PURIFYING MATERIAL.

Connelly & Co., Pittsburgh, Pa. 159

TAR BURNER, AND BLOWER FOR BURNING BREESE.

H. E. Parson, New York City..... 158

PROCESSES.

Strong Gas-Fuel and Light Co. 159
Gwynne Harris, New York City..... 162

GAS FIXTURES.

Mitchell, Vance & Co., New York City..... 161

CEMENT.

S. L. Merchant, New York City..... 161
F. O. Norton, New York City..... 161

BOOKS.

Economy of Gas as a Fuel... 160
Scientific Books..... 162
Cathels, Gas Consumer's Manual..... 167
Fodell's Book-Keeping..... 167
Sanitary Engineer..... 167
Journal des Usines a Gaz..... 159
Review of Gas and Water Engineering..... 164
Gas Analyst's Manual..... 163

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERSEY.

HENRY MAURER,

Excelsior Fire Brick & Clay Retort Works

CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

VALUABLE PATENT FOR SALE.

Improved Price Indicator for Gas Meters.

This invention consists of an ADJUSTABLE price indicator, working in connection with the cubic feet indicators, and enabling anyone who can read figures to see at a glance the value of the gas, in dollars and cents, that has passed through the meters. No matter at what price gas is sold, or how often the price is changed, the indicator can always be used; and any change can be made at a cost of a few cents for each meter, and without removing the same. Responsible parties desirous of securing this patent, and meaning business, may address

P. O. BOX 483, NORFOLK, VA.

Ammoniacal Liquor and Coal Tar.

SEALED PROPOSALS

will be received at the office of the Cincinnati Gas Light and Coke Company, Cincinnati, Ohio, until 12 o'clock noon, May 1st, 1880, for the Ammoniacal Liquor produced at the works of said Company, extending over a period of *five* (5) *years* from July 1, 1880.

The Liquor will be delivered in car-tanks on side track, in tank barges on the river, or at any point on the line of the Gas Company's premises. The strength to be of the same average as at present.

Bids will be received at so much per ton, of 2000 pounds, of coal carbonized. Payments to be made monthly. Security in the sum of $10,000 will be required. The Company reserves the right to reject any and all bids. If desired by the successful bidder, arrangements can be made for the purchase of the Coal Tar produced during the same period.

Address,

ROBT. BROWN, Jr., Sec'y,
Cincinnati Gas Light and Coke Co., Cincinnati, O.

"Light on the Subject of Gas & Gas Companies."

A small Pamphlet for gratuitous distribution to consumers.

Information, Illustration, Explanation, Argument, Condensed.

Specimen copies, with terms, mailed to GAS COMPANIES on receipt of two-cent postage stamp.

J. H. DAWSON,
Sec'y City Gas Light Company, Norfolk, Va.

SITUATION WANTED

BY A MAN THIRTY YEARS OF AGE,

Thoroughly Qualified to take Charge of Small Gas Works.

Seven years' experience in an engineer's office and around works. Would take a subordinate position. Open to correspondence. Good references. Address, "ENERGY,"

449-tf Care this Journal.

ENGAGEMENT DESIRED.

A Person of Practical Experience as Superintendent of Gas Works

Desires an engagement where strict attention to the duties confided to him will secure ultimately a fair compensation. References can be given. A good, permanent position is desired, where future salary would depend on success of management. Address, "ENGAGEMENT."

Office GAS LT. JOURNAL.

MORRIS, TASKER & CO., LIMITED.

MANUFACTURERS AND BUILDERS OF

GAS WORKS.

PLANS, SPECIFICATIONS, AND ESTIMATES FOR WORK ERECTED OR ON CARS IN PHILADELPHIA.

WROUGHT IRON ROOF FRAMES.—For Slate or Corrugated Iron, with Cast Iron Cornice Gutter, Iron Doors and Frames, Wrought Iron Pivot Window Blinds, and all kinds of Castings and Smiths' Work for Buildings.

BENCH CASTINGS.—Retorts, and all castings and Wrought Iron Work for setting them on the best plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons, and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes, to pass from 4,000 to 150,000 cubic feet of gas per hour, with Engines, Governors, Pressure and Vacuum Gauges.

SCRUBBERS.—Cataract, Single and Multitubular, Spray and Tower Scrubbers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Riveted Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arrranged either for Floor or Overhead use.

METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gas Holders, with Cast or Wrought Iron Suspension Frames, Housed or Open, Flat Top or Trussed.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three to twenty-four inches diameter. Flange and Bell Pipes, Fitting and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating, Building and Gas Holder Tanks, Lamp Posts and Lanterns.

PATENT SELF-SEALING RETORT LID. PATENT SEALING AND UNSEALING DIP PIPES.

MORRIS, TASKER & CO., Limited,

WORKS: FIFTH and TASKER STS., Phila. OFFICE: 230 S. 3d. St. Phila.

CAST IRON PIPE.

WE HAVE ON HAND, IN STORE, FOR IMMEDIATE SHIPMENT,

A Large Quantity of Cast Iron Pipe,

WITH A FULL ASSORTMENT OF SPECIAL CASTINGS.

MOST OF THEM ARE GAS WEIGHTS—PART OF THEM COATED WATER WEIGHTS.

Made by Warren Foundry, Wood, McNeals, and Camden Iron Works,

UNDER CAREFUL INSPECTION, AND ARE OF THE VERY BEST QUALITY.

PANCOAST & TARR, 28 Platt St., New York.

JOURNAL des USINES a GAZ.

Issued on the 5th of each Month.

THIS JOURNAL CONTAINS ALL THE LATEST SCIENTIFIC AND PRACTICAL INFORMATION RELATING TO GAS MANUFACTURE IN FRANCE.

MESSRS. SERVIER, MONNIER, AND ROUGET, EDITORS AND MANAGERS.

Subscriptions Received at this Office. Price, Post-paid, $3.50 Per Annum.

Complete Gas Works
FOR SALE.

The Iron Work for a complete Gas Works, with 8 inch connections, consisting of 4 Purifiers, 8 ft. by 10 ft., with Dry Centre Valve, Multitubular Condenser, Scrubber, Bye-pass Valves, 5 feet Station Meter, and Bench Casting for four benches of 5's. All nearly new, and in good condition.

THE MUTUAL GAS LIGHT CO.,
ST. JOSEPH, MISSOURI.

497-tf

C. GEFRORER.
Manufacturer of
GAS BURNERS

GAS HEATING AND COOKING APPARATUS.

FITTERS' PROVING APPARATUS, ETC.

No. 248 North Eighth Street, Philadelphia.

WATER GAS.

Strong Gas-Fuel and Light Co.,
No. 120 Broadway,
(EQUITABLE BUILDING), NEW YORK.

This Company is the Sole Proprietor for the State of New York of the Strong and Lowe Processes for the Manufacture of Water Gas.

Works are now being constructed according to the Strong patents at Yonkers, to supply that city with gas for

Light, Heat, and Power.

One pair of generators, the cost of which will not exceed $18,000, will make about 400,000 cubic feet per day.

The Lowe system is already in successful operation for lighting in more than thirty places in the United States, and in many of our large cities.

The rapid progress that water gas is making in the public favor, and the great economy and efficiency of the Strong and Lowe processes over all others for its manufacture, should secure for these processes a careful examination on the part of all gas companies now existing or about to be formed.

N. B.—For licenses or further information, appply at the office of this company, as above.

Dated March 8, 1880.

CONNELLY & CO.,
SOLE MANUFACTURERS OF
Iron Sponge Purifying Material
AND
CONNELLY'S JET EXHAUSTERS.
PITTTSBURGH, PA.

GEO. W. DRESSER,
CIVIL ENGINEER.
TRINITY BUILDING

ROOM 89. 111 BROADWAY.

J. H. GAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and
Fire Sand in Barrels,
J. H. GAUTIER.
393-1y C. E. GREGORY

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE
FIRE BRICKS AND
GAS RETORT WORKS
CHELTENHAM, MO.
Hand and Machine made Retorts and Settings, Superior Fire Bricks for Siemans Gas and Glass Furnace. Bricks and Tiles for Whitwell's Hot Blast Ovens, Blast Furnace and Cupola Tiles, Etc.
Fire Bricks and Tiles
of all shapes and sizes.
Glass Pot Clay. Fine Ground Cla yand Fire Bricks. Sewer Pipe, Etc.
901 Pine Street, St. Louis, Mo.
642—

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Cas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

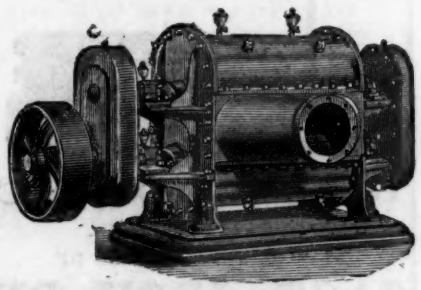
Borgner & O'Brien,
MANUFACTURERS OF
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.
23d St., Above Race,
PHILADELPHIA.
TWENTY YEARS' PRACTICAL EXPERIENCE.

Works, LOCKPORT, PA.
GARDNER BROTHERS,
Works, MT. SAVAGE JUNCTION, MD.
—ESTABLISHED 1864.—
CLAY GAS RETORTS, RETORT SETTINGS, FIRE BRICK, TILES, Etc.
MINERS & SHIPPERS OF FIRE CLAY.
OFFICE, 116 SMITHFIELD ST., PITTSBURGH, PA.
C. H. SPRAGUE, No. 13 EXCHANGE PLACE, BOSTON, MASS., Agent for the New England States.

—THE—
ECONOMY OF GAS AS A FUEL
FOR
COOKING PURPOSES.

This is a small Pamphlet containing the Paper read by
MR. WILLIAM W. GOODWIN, OF PHILADELPHIA, PA.,
At the recent meeting of the American Gas Light Association.
IT IS INTENDED FOR GRATUITOUS DISTRIBUTION BY GAS COMPANIES AMONG THEIR CONSUMERS
Price, Twelve Dollars per Thousand.
ALL ORDERS TO BE SENT TO
A. M. CALLENDER & CO., No. 42 Pine Street, New York.

P. H. & F. M. Roots'



IMPROVED GAS EXHAUSTER

With Engine on same Bed Plate, or without.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, &C., FURNISHED TO ORDER.

P. H. & F. M. ROOTS, Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 6 Cortland St. and 8 Dey St., N. Y.
JAS. BEGGS & CO., Selling Agents, 8 Dey St., N. Y.
WM. COOKE, Selling Agent, 6 Cortland St., N. Y.

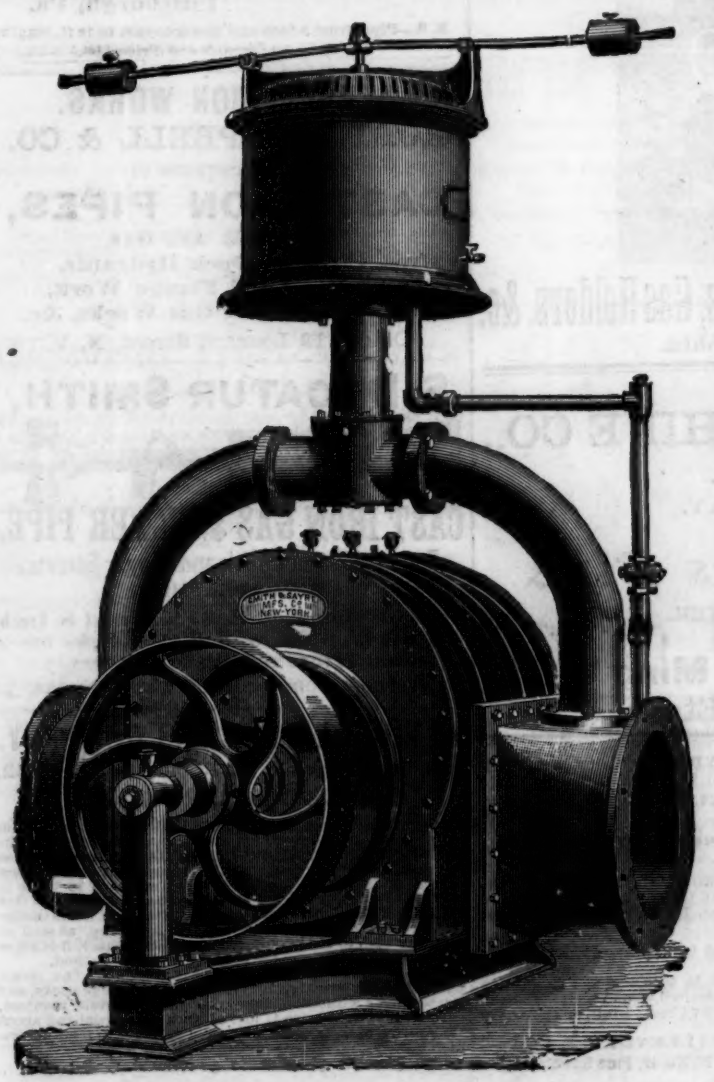
Send for Illustrated Catalogue and Price List.

SMITH & SAYRE MANUFACTURING COMPANY.

Coal and Iron Exchange, 21 Cortlandt Street, N. Y

BUILDERS OF

Machinery and Apparatus for Gas Works.



MACKENZIE'S PATENT ROTARY AND STEAM JET GAS EXHAUSTERS, GOVERNORS, COMPENSATORS, BY-PASSES, CONDENSERS, WASHERS, SCRUBBERS.

ISBELL'S PAT. AUTOMATIC STREET PRESSURE GOVERNOR.

HIGH SERVICE GOVERNOR, GAS AND WATER VALVES, HYDRAULIC MAIN DIP REGULATOR, BENCH CASTINGS, Etc. PURIFYING BOXES, TOWER SCRUBBERS, WITH AUTOMATIC WATER DISTRIBUTOR. *ISBELL'S PATENT SELF-SEALING RETORT DOORS.*

Plans and Estimates for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

G. G. PORTER, *President.* CHARLES W. ISBELL, *Secretary.*

MITCHELL, VANCE & CO.

Manufacturers of

CHANDELIERS!

And Every Description of

GAS FIXTURES,

Also Manufacturers of

Fine Gilt Bronze and Marble Clocks, warranted best Time-keepers Mantle Ornaments, &c.

Salesroom, 836 BROADWAY.

NEW YORK.

Special designs furnished for Gas Fixtures for Churches Public Halls, Lodges, &c.

LUDLOW

Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave.

TROY, NEW YORK.

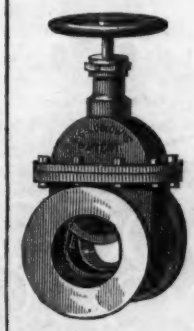
BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ¼ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—

HYDRAULIC MAIN DIP REGULATORS.

ALSO

FIRE HYDRANTS.



REFERENCES FURNISHED.

SEND FOR CIRCULARS.

Portland Cement,
Roman Cement,
Keene's Cement,
Sellurs Gas Cement.

English Fire Brick, No. 1.
" Silica Fire Brick.

IMPORTER

S. L. MERCHANT,

53 Broadway, New York,
Just below Trinity Church. 344-1y

☞ Remit 10 cents postage for "Practica Treatise on Cement.

F. O. NORTON,

MANUFACTURER OF

Hydraulic Cement,

Specially adapted for gas works. Under water it is capable of giving better results than Portland or any other cement.

90 BROADWAY (Cor. Wall St.,) NEW YORK.

Preserve the Journal!

We will furnish to our subscribers an important article for *preserving in a convenient form*, the numbers of the Journal as it is issued at the very low price of $1.25. Sent either by Express or Mail, as directed.

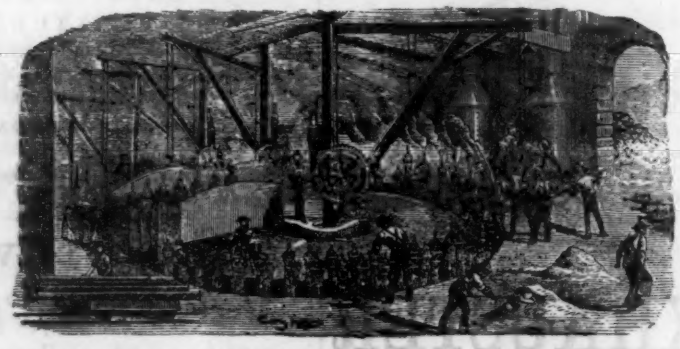
By mail the postage will be 20 cents, which will be added to the price of the Binder. Send orders to

A. M. CALLENDER & CO,
42 Pine Street, Room 18, New York.

M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

DAVID S. BROWN, President.
BENJAMIN CHEW, Treasurer,

JAMES P. MICHELLON, Secretary,
WILLIAM SEXTON, Superintendent.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY N. J.

CastIron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gas Holders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO,,

WORKS AT PHILLIPSBURGH, N, J.
NEW YORK OFFICE, 153 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 436-1

SCIENTIFIC BOOKS.

We are prepared to furnish to GAS MANAGERS and others interested in the topics treated of, the following Books, at prices named :

GAS MANUFACTURE, by WILLIAM RICHARDS, 4 to, with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

ANALYSIS, TECHNICAL VALUATION, PURIFICATION and USE OF COAL GAS, by Rev. W. R. BOWDITCH, M. A., with Engravings. 8 vo Cloth. $4.50.

NEWBIGGINS HAND BOOK, by THOMAS NEWBIGGIN, C. E. $2.75

GAS CONSUMERS HAND BOOK, by WM. RICHARDS, C. E. 18 mo. Sewed. 20 Cents.

GAS CONSUMERS MANUAL, by E. S. CATHELS, C.E. 10 Cents.

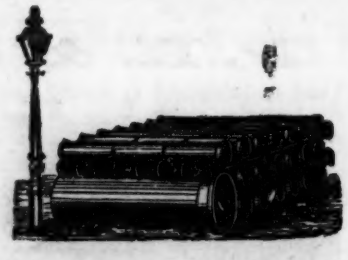
PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

AIR AS FUEL, OR PETROLEUM AND OTHER MINERAL OILS UTILIZED BY CARBURETTING AIR, by OWEN C. D. ROSS, Member Institute Civil Engineers. 8 vo. Cloth. $1.50.

The above will be forwarded by Express, upon receipt of price.

We will take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances must be made by Check, Draft, or Post Office Money Order.

A. M, CALLENDER & CO.,
Room 18, No. 49, Pine Street, N. Y.



R. D. WOOD & CO.,

PHILADELPHIA.
MANUFACTURERS OF

CAST IRON PIPE

FOR GAS AND WATER
Lamp Posts, Valves, Etc.
Mathew's Pat. Anti-Freezing Hydrants,
400 Chestnut Street.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES

Works, 18th, 19th, 20th and Railroad Street.
Office, No. 23 Nineteenth Street.
Pittsburgh, Pa.

N.B.—Pipes from 3-inch and upwards cast in 12 ft. lengths.
☞ Send for Circular and Price List.

BERGEN IRON WORKS.

ROBT. CAMPBELL & CO.

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,
Valves, Fire and Dock Hydrants,
Lamp-Posts and Flange Work,
Bench Castings for Gas Works, &c.
Office 112 Leonard Street, N. Y.

S. DECATUR SMITH,

CAST IRON GAS & WATER PIPE,

Foundry, Cor. of York and Moyer Streets,
PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS. ☜

NATIONAL COAL GAS COMPANY.

320 Broadway, N. Y., Rooms 50, 51 & 52.

H. P. ALLEN, President.

The process known as GWYNNE-HARRIS, but from later most essential improvements, more appropriately called the ALLEN-HARRIS, or AMERICAN HYDROCARBON process for making "Water Gas," by the decomposition of superheated steam, in fire-clay retorts, set similarly to those in Coal Gas Works, is an established success. More than One Hundred Million cubic feet of gas have been made under this process, and for *permanency* and *brilliancy*, as well as economy both to the manufacturer and consumer, it is superior to any gas made by the old, or any other method.

Our process is *not intermittent* but continuous. The steam and the oil are admitted into the retorts by gauge cocks, and run for days without change. All the materials required, besides the steam, are 17 lbs. of Anthracite coal and about 3½ gallons of Petroleum or Naphtha, per 1000 feet of brilliant gas.

Rights for sale. Inquire of the President.

Kerr Murray,

PRACTICAL GAS ENGINEER,

AND MANUFACTURER OF

ALL THE LATEST IMPROVED

Gas Apparatus,

MACHINERY,

ETC., ETC.

—WORKS,—

South of Railroad Depot,

FORT WAYNE, IND.

BARTLETT, ROBBINS & CO.,

ARCHITECTURAL IRON WORKS.

MANUFACTURERS OF

GAS HOLDERS, BENCH CASTINGS, MULTITUBULAR WATER AND AIR CONDENSERS, COMMON AND TOWER SCRUBBERS, ROTARY & STEAM JET EXHAUSTERS, WROUGHT IRON ROOF FRAMES.

MANUFACTURERS OF ALL DESCRIPTIONS OF GAS APPARATUS.

WORKS:

Cors. Pratt, Scott, McHenry, Ramsay and Bartlett Streets.

BALTIMORE, MARYLAND.

Plans, Specifications, and Estimates furnished. Correspondence solicited. 467-1y

---

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames.

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

or Purifiers. Station Meters of all sizes.

GAS HOLDERS.

TELESCOPIC AND SINGLE

With cast iron guide and suspension frame GAS GOVERNORS or REGULATORS, STREET MAINS, from 1¼ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 235-tf

JESSE W. STARR. JESSE W. STARR, JR.

1842. DEILY & FOWLER 1880.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

PHILADELPHIA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. We have built 12 gas works and 122 gasholders. Personal supervision given to the erection of all our work.

Holders built at following places since 1868:

Lancaster, Pa. (2)
Williamsport, Pa. (3)
Bristol, Pa. (2)
Catasaqua, Pa.
Kittanning, Pa.
Hazelton, Pa.
Freeport. Pa.
Huntingdon, Pa.
Pittston Pa.
Bethlehem (S). Pa.
Sharon, Pa.
Canton, Pa.
Carlisle, Pa.
Beaver Falls, Pa.
Annapolis, Md. (2)
Parkersburg, W. Va.
Lynchburg, Va.
Stanton, Va.
Youngstown, O
Steubenville, O.
Zanesville, O.
Mansfield, O.
Marion, O.
Bellcaire, O.
Athens. O,
Barnesville, O.
Newark, O.
Columbus, O.
Franklin, Ind.
Indianapolis, Ind.
Jacksonville, Ill.
Joliet, Ill.
Lawrence, Kansas.
Jefferson City, N. O. La. (2)
Algiers, N. O., La.
Kalamazoo, Mich
Buffalo, N. Y. (2)
Ogdensburg, N. Y.
Waverly, N. Y.
Little Falls, N. Y.
Penn Yann, N. Y.
Watkins, N. Y.
Coney Island, N. Y.
Batavia, N. Y.
Gloucester, N. J.
Salem, N. J.
Mount Holly, N. J.
Plainfield, N. J.
Englewood, N. J.
Flemington, N. J. (2)
Dover, Del.
Pittsfield, Mass.
Meriden, Conn.
Milwaukee, Wis.
Burlington, Vt.
Hoosick Falls, N. Y.
Attica, N. Y.

BROWN & OWEN,

MANUFACTURERS OF

EVERY DESCRIPTION OF

Gas and Water Works Supplies.

Particular attention given to the alteration of old works. Estimates and Drawings furnished.

THOS. R. BROWN, **R. PITT OWEN.**

Late Chief-Eng. Phila. Gas Works.

Address all communications to

N. W. Cor. 12th and Noble Streets,

482-1y **PHILADELPHIA.**

HERRING & FLOYD,

Oregon Iron Foundry

738, 740, 742 and 744 Greenwich St., N. Y

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS: MULTITUBLAR AND AIR CONDENSERS: CONDENSERS; SCRUBBERS,
(wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
of all sizes and description.

FLOYD'S PATENT
MALLEABLE RETORT LID.
BUTLER'S
COKE SCREENING SHOVELS.

SABBATON'S PATENT
FURNACE DOOR AND FRAME.

SELLER'S CEMENT
for stopping leaks in Retorts.

GAS GOVERNORS,
and everything connected with well regulated Gas Works low price, and in complete order.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.

SILAS C. HERRING. JAMES R. FLOYD

GEO. STACEY. HENRY RANSHAW. WM. STACEY

GEO. STACEY & CO.

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS

AND ALL KINDS OF

Cast and Wrought Iron Work

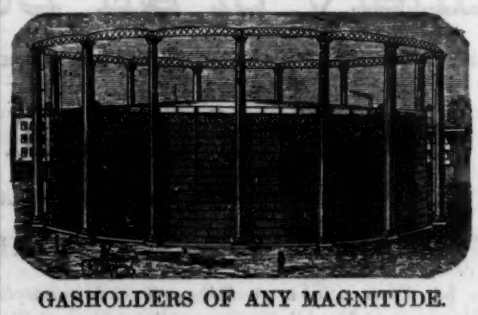
Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39 Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

Cincinnati Gas-Light Co.
Indianapolis Gas Co.
Dayton, O., Gaslight Co.
Covington, Ky., Gas Co.
Springfield, O., Gas Co.
Terre Haute, Ind., Gas Co.
Madison, Ind., Gas Co.
Kansas City, Mo., Gas Co.
Topeka, Kansas, Gas Co.
Burlington, Iowa, Gas Co.
Nashville, Tenn., Gas Co.
Baton Rouge, La., Gas Co.
Saginaw, Mich., Gas Co.
Oshkosh, Wis., Gas Co.
Peoria, Ill., Gas Co.
Quincy, Ill., Gas Co.
Champaign, Ills., Gas Co.
Carlinville, Ill., Gas Co.
Bowling Green, Ky., Gas Co.
Hamilton, Ohio, Gas Co.
Vicksburg, Miss., Gas Co
Denver City, Col., Gas Co.
R. T. Coverdale, Eng'r Cincinnati, and others.

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,

GREENPOINT, BROOKLYN, N. Y

ENGINEER AND MANUFACTURER OF

GAS-HOLDERS,

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

THE GAS ANALYST'S MANUAL.

BY F. W. HARTLEY, A.I.C.E., M.S.E. **E. & F. N. SPON, PUBLISHERS.**

PRICE, $2.50.

CONTENTS. SECTION I.—The purposes of photometry. Standard light. Standard burner. Gas Works Clauses Act Amendment Act, 1871:—Regulations in respect of testing apparatus, mode of testing for illuminating power, and for sulphuretted hydrogen. Description of standard apparatus. The photometer room. Preparation of candles. Testing operations. Readings. Correction for gas consumpt. Corrections for candles' consumpt. Corrections for barometric pressure and temperature. Ordinary photometers. The inferential or jet photometers. To set the jet photometer at work. To rate the jet photometer.

SECTION II.—Duration and mode of testing in London, sulphuretted hydrogen, ammonia, sulphur compounds. Preparation of solutions. Fitting up. To set the apparatus at work. Analysis.

SECTION III.—Ammonia. Sulphuretted hydrogen. Carbonic acid. The Cooper's Tube, or Eudiometer. To calculate weight of sulphur. Harcourt's color test. A rapid and accurate methodof estimating sulphur in coal gas. Specific gravity. To find the specific gravity of dry gas. To correct the bulk and find the weight of gas.

APPENDIX.—Rules and tables to facilitate the calculations necessary in the determination of the illuminating value and degree of purity of coal gas. Photometry. Ammonia and sulphur. Proving of testing meters in London. The gas referee's cubic-foot measure. Times and mode of testing for pressure in London. Proposed standards of light.

A. M. Callender & Co., 42 Pine Street, N. Y.

NEWCASTLE AND PROVINCIAL GAS COALS.

THE UNDERSIGNED ARE PREPARED TO EXECUTE ORDERS FOR

NEWCASTLE COAL (TOWNLEY),

ALSO FOR THE BEST QUALITIES OF

PROVINCIAL GAS COAL,

DELIVERED AT ANY PORT IN THE UNITED STATES.

We supplied nearly 100,000 tons of Provincial Coal to some twenty-five different Gas Companies in 1877. These coals will yield in practical use fully

10,000 Cubic Feet of 16 1-2 Candle Gas---40 Bushels Coke.

JAMES D. PERKINS.
F. SEAVERNS.

PERKINS & CO.

41 SOUTH STREET, NEW YORK.

THE

British Cannel Co.

CENTRAL COAL OFFICES,

MANCHESTER, ENG.

This Company is prepared to ship the best varieties of Scotch, English, and Welsh Cannels and Gas Coals to all American ports.

THE ECONOMY

OF

GAS AS A FUEL

FOR

Cooking Purposes.

Price, $12 a Thousand.

Montauk Gas Coal,

FROM

TAYLOR CO., WEST VA.

JOHN WHITE,

AGENT,

Room 15, Trinity Building,

NEW YORK.

THE AMERICAN GAS-LIGHT JOURNAL.

$3 PER ANNUM.

Ellis Lever & Co.,

GAS COAL AND CANNEL

Contractors,

No. 6 PICCADILLY,

MANCHESTER, ENGLAND.

The best classes of Cannel and Gas Coals raised in Great Britain are supplied by the above firm for home and export.

KING'S TREATISE

ON

COAL GAS.

Vol. I., Bound in Cloth, $10.

A. M. CALLENDER & CO., 42 Pine Street, N. Y.

T. B. RITER, *President.* W. J. MILLER, *Sec. and Treas.* P. MUNZINGER, *Eng. and Supt.*

MONONGAHELA GAS WORKS MANUFACTURING CO.,

(LIMITED.)

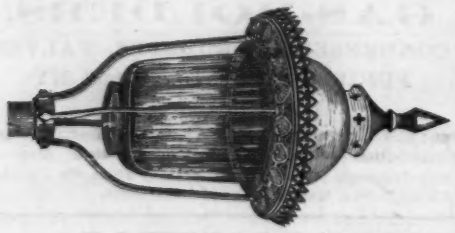
—WORKS,— —OFFICE,—

39 & 54 Water St., Pittsburgh, Pa. **1211 Market St., Phila., Pa.**

MANUFACTURERS AND BUILDERS OF

Gas Machinery of all Descriptions.

PLANS AND ESTIMATES FURNISHED ON APPLICATION. Address Correspondence 1211 MARKET STREET, PHILA., PA.



THE GLOBE STREET LAMP,

Miner's Patent Lamps for Streets, Depots, Ferries, etc., in Various Styles, are Solely Manufactured by

Jacob G. Miner,

MORRISANIA, N. Y. CITY.

N. B.—These Lamps in many cases are the cheapest to commence with, always cheapest in the end.

Review of Gas and Water Engineering.

ISSUED EVERY ALTERNATE FRIDAY.

Edited and Published by CHAS. W. HASTINGS, 8 Buckingham St., London, Eng.

Each number contains articles in connection with the manufacture and supply of Gas; summary of latest intelligence on the subject of Electric Lighting; articles upon Water Supply; also on the Construction and Maintenance of Gas, Water, and Sewage Works.

Price, 10s., Postpaid.

The Gas and Water Companies' Directory.

Edited and Published Annually by CHARLES W. HASTINGS.

This Work gives a complete list of all Gas and Water Companies throughout England, Scotland, Ireland and Wales; date of formation, amount of capita and names of all officers, etc.; including carbon returns, prices paid for gas, dividends, etc.

Price, in Cloth Covers, 5s.; Paper Covers, 3s. 6d. Postage Extra.

Address, **8 BUCKINGHAM STREET,**

Orders Received at this Office. **LONDON, W. C., ENGLAND.**

NEW YORK AND CLEVELAND

GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favorable terms.

General Office—89 Wood Street,
PITTSBURGH, PA.

Branch Office—120 Water Street,
CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent at Cleveland, Ohio.

351-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

234-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested. 204-a

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superio Coke, with little Ash and scarcely any clinker 94-1y

FORT PITT GAS COAL

This Company is prepared to supply any amount of their

Celebrated Gas Coal

all points reached by rail or lake throughout the West.

THE FORT PITT COAL COMPANY,

OFFICE 337 LIBERTY STREET,

PITTSBURGH, PA

GAS COALS.

THE

PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 209 South Third Street, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL COMPANY

Miners of the celebrated **CANNELTON CANNEL,** acknowledged to be the *best enricher* produced in this country, yielding **10,000** cubic feet of **64.54** candle gas per ton of 2,240 pounds.

J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.

SALES AGENTS: **PERKINS & CO.,** New York. **DANIEL W. JOB & CO.,** Boston. **MAYER, CARROLL & CO.,** Baltimore.

The West Fairmont and Marion Consolidated Coal Company,

Mines at Fairmont, West Virginia,

OFFER FOR SALE THEIR

VERY SUPERIOR GAS COAL,

IN ANY QUANTITY DESIRED, on the shortest notice, at their office, 231 BROADWAY, New York

PERKINS & CO.,

41 SOUTH STREET N. Y.

IMPORTERS AND AGENTS FOR THE SALE OF

AMERICAN, PROVINCIAL, and ENGLISH

GAS COALS AND CANNEL.

JAMES D. PERKINS. F. SEAVERNS, JR.

"SCOTT'S" OCEAN MINE

Youghiogheny Gas Coal.

The undersigned, agents for the above well-known Gas Coal, are prepared to contract for its delivery at any point in New York and New England. Shipments made immediately if desired.

PERKINS & CO.,

41 SOUTH STREET, NEW YORK, Box 3695.

"HOW TO BURN GAS,"

TEN DOLLARS PER THOUSAND.

A. M. CALLENDER & CO., 42 PINE STREET, NEW YORK.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S, A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

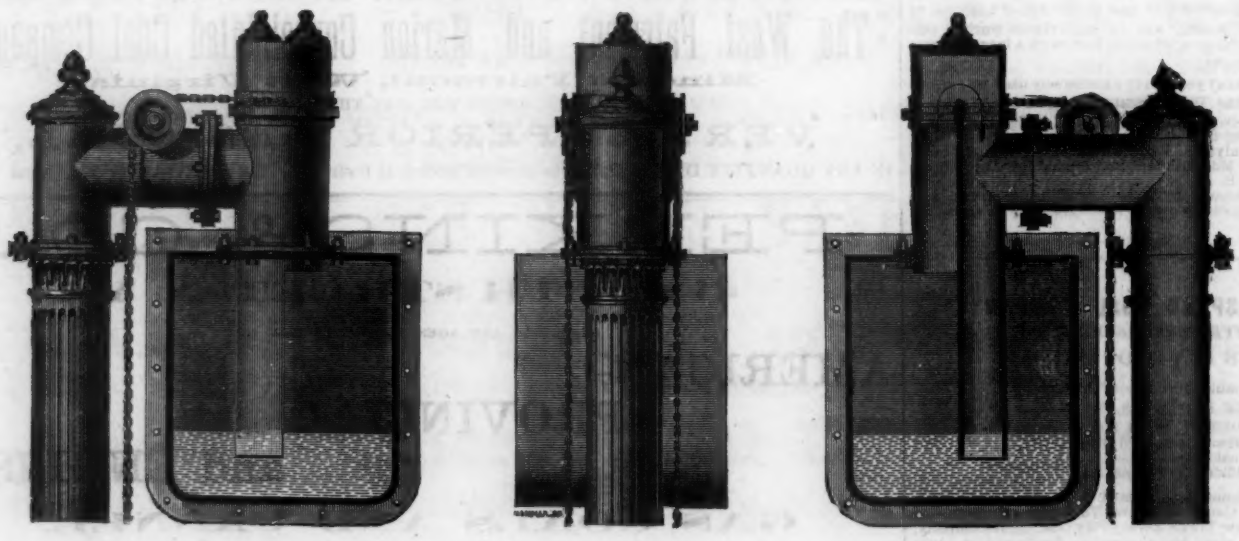
GROUP JUDGES.

AMERICAN.

PROF. JOSEPH HENRY, LL.D., Secretary of Smithsonian Institution, Washington, D. C.
PROF. F. A. P. BARNARD, S.T.D., LL.D., President of Columbia College, N. Y.
PROF. J. E. HILGARD, Washington, D. C.
PROF. J. C. WATSON, Ann Arbor, Michigan.
GENERAL HENRY K. OLIVER, Salem, Massachusetts.
GEORGE F. BRISTOW, New York.

FOREIGN.

SIR WILLIAM THOMSON, LL.D., D.C.L., F.R.S., Great Britain
JUL. SCHIEDMAYER, Germany.
MR. E. LEVASSEUR, France.
P. F. KUPKA, Austria.
EDW. FAVRE PERRET, Switzerland.



FARMER'S PATENT BYE-PASS DIP-PIPE.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

ROOMS 87, 89, 91, 111 BROADWAY, NEW YORK.

WILLIAM FARMER may be consulted upon all matters relating to the Manufacture of Illuminating Gas. Will furnish Specifications, Drawings, and Estimates for the Erection of Gas Works of any Capacity, and will erect the same either on Commission or by Contract.
Having made the Construction of Gas Works a Specialty, perfect satisfaction can be guaranteed.
Sole Agent for the FOULIS HYDRAULIC MACHINE for Drawing and Charging Retorts.
Sole Agent for the AITKEN and YOUNG PROCESS FOR MAKING ILLUMINATING GAS.

PATENTEE OF THE FOLLOWING INVENTIONS.

EXHAUSTER (Screw Propeller) for Gas or Air, and Condensation. **DUMPING BARROW** for Wheeling Coal, Coke and Lime, Etc. **HYDRAULIC MAIN** for Reducing Pressure on Retorts. **ZIGZAG SCRUBBERS** for Naphthalizing the Gas and Removing the Tar, Ammonia, and Naphthaline. **BYE-PASS DIP PIPE** for reducing the Pressure on Retorts, Etc., as per cut above. **SELF-ACTING WATER DISTRIBUTOR** for Scrubbers and Washers, Etc. **MOVABLE DIP PIPE** for Reducing and Equalizing the Pressure on Retorts. **TOWER SCRUBBERS** (Jacketed) for Economizing Space and Building Material. **DUPLEX CENTRE SEAL** for Keeping all the Boxes in a set continuously in action.

REFERS BY PERMISSION TO THE FOLLOWING GENTLEMEN.

PROFESSOR B. SILLIMAN, New Haven, Conn.
GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
GEN. A. BECKENLOOPER, President Cincinnati Gas-Light Co., Cincinnatti, Ohio.
A. W. BRENON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
D. HOSTETTER, President Pittsburgh Gas-Light Co., Pittsburgh, Pa.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
M. VANDERPOOL, Engineer, Newark Gas-Light Company, Newark, N. J.

T. C. HOPPER, Prest. and Gen. Supt. WM. H. HOPPER, Vice-Prest. WM. N. MILSTED, Treas. WM. H. DOWN, Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES—AMERICAN, FRENCH, & ENGLISH.
SUGG'S ILLUMINATING POWER METER.
SUGG'S "STANDARD" ARGAND BURNERS. ALSO NN AND TTT.
Wet Meters, with Lizar's "Invariable Measuring" Drum.
SOLE AGENTS FOR THE ALLEN EXHAUSTER GOVERNOR.

Agencies:
37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco.

HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 33 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WILLIAM HELME. JOHN McILHENNY.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. H. DUMONT WAGNER, Supt. S. L. JONES, Sec. S. V. MERRICK, Asst. Sec.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street, Philadelphia, Pa.

No, 142 Chambers Street, New York

MANUFACTURERS OF GAS STOVES FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

THE PLUMBER
AND
SANITARY ENGINEER.

HAS BEEN ENLARGED, AND WILL NOW BE

Published on the First and Fifteenth of each Month,

Instead of Monthly. It will contain many new and valuable features, and thus be indispensable to everyone professionally interested in its special field—*Lighting, Heating, Ventilation, Water Supply, and Drainage.*

Regular Contributors:

EDW. S. PHILBRICK, C.E. GEO. E. WARING, JR., C.E. Prof. HENRY MORTON, Ph.D.
ROBERT BRIGGS, C.E. T. O'CONOR SLOANE, Ph.D. DR. JOHN H. BILLINGS, U.S.A.

Price, $2 a Year. Single Copies, 10 Cents.

THE PLUMBER & SANITARY ENGINEER,
P. O. Box 3037. 140 WILLIAM STREET, New York.

NOW READY AND FOR SALE,

FODELL'S
System of Bookkeeping
FOR GAS COMPANIES.

Price $5, which should be sent either in Check P. O. Order or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL Philadelphia, or

A. M. CALLENDER & CO
OFFICE GAS LIGHT JOURNAL, 42 Pine St., N. Y

CATHEL'S
GAS CONSUMERS MANUAL.

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & CO.
42 Pine Street, New York, Room 18.

NOTICE TO GAS COMPANIES.

Office of the Goodwin Gas Stove and Meter Company,
1012, 1014, 1016 Filbert St., Phila., & 142 Chambers St., N. Y.

The addition to our business of a department for the manufacture and sale of Stoves for Cooking and Heating by Gas, and the large proportions which this branch is already assuming, has suggested to us the propriety of associating others with us in the management of our business, whereby its increasing labor will be divided, and greater means commanded for its extension, in both the old and new departments.

With these objects in view, the business formerly conducted under the firm name of W. W. Goodwin & Co., will be continued under the corporate title of "The Goodwin Gas Stove and Meter Company," at the old stand, Nos. 1012, 1014, and 1016 Filbert Street, Philadelphia, and at the branch house, No. 142 Chambers Street, New York, which continues under the management of Capt. Wm. Henry White. The Company will continue to manufacture Consumers', Experimental, and Show Meters of all varieties; Meter Provers, Pressure Registers, Pressure and Vaccuum Registers, Photometrical, Chemical and Testing Apparatus of all kinds, and of the most perfect workmanship.

With grateful recollections of the liberal patronage of our friends in the past, during a period of unexampled depression in trade, as well as when our business was in its infancy, we feel that now, with improved facilities and more prosperous times, we may confidently look forward to an increase of that business which it will be our pride to merit.

The officers of the Company are: W. W. Goodwin, President and Treasurer; Wm. H. Merrick, Vice-President; H. Dumont Wagner, Superintendent; S. Lewis Jones, Secretary; Samuel V. Merrick, Assistant Sec.

WILLIAM W. GOODWIN, President.